Bothalia

A RECORD OF

CONTRIBUTIONS

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PRETORIA

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By S. SCHONLAND.

(Illustrated *)

A.—*Introduction with Brief Historical Notes.*

The South African species of *Rhus* are placed by Engler (in De Candolle, Monographiae Phanerogamarum IV, 1883) into his section *Gerontogeae*. The section is characterized by him as follows: *Drupae globosae plerumque laeves, raro pilosae, mitio compressae, mesocarpio crasso paullum resinoso vittato cum endocarpio cohaerente, exocarpio demum soluto. Folia semper trifoliolata, raro digitata, 5-foliolata.* The section seems to be an unusually natural one. Since the publication of the first volume of the Flora Capensis in 1859-60 no account of these plants which form such important constituents of our Flora has been readily available to South African students. Quite a number of new species have been described in Engler's work just cited and additional ones have been published from time to time by various authors. At the same time some species have been found to be untenable as material accumulated. With few exceptions the work done on the plants of this section has, by previous authors, been based on Herbarium material. This has frequently been too scrappy. Our species are normally dioecious and both sexes are required for descriptive purposes. In addition ripe fruits are required. Coppice shoots are frequently decidedly different from the shoots of adult plants. The branching and size of the inflorescence yield important characters, also the petiole and last, but not least, the leaflets. The flowers are distinguished only by minute characters which only rarely can be satisfactorily used in distinguishing the species. Unfortunately the vegetative organs are very variable, often on the same plant. To quote only a few examples. In *Rh. dentata* the dentation may vary on the same branch or may be absent altogether. Hairy and glabrous leaflets may be found on the same branch in this species. In a large group to which he refers 61 species, Engler divides these into species with winged petioles and those without wings, but these wings are often not developed, e.g. in *Rh. longispina*, where sometimes they reach their maximum development. Again, the shape of the leaflets may be quite protean, e.g. in *Rh. MacOwani* I picked from one bush leaflets which were ovate-acute, ovate-obtuse, obovate-obtuse, obovate-emarginate. They were mostly quite entire, but there were some with one crenation near the apex, others had 2, some 3, a few had more. Most of the leaves were 3-foliolate, but some were 5-foliolate.

From the descriptions of the species it will be seen that such instances are very common. This makes the construction of satisfactory keys to guide the beginner practically impossible. Only recently Prof. Engler, with reference to his key in "Die Pflanzenwelt Afrikas" mentioned to me that it must be used in conjunction with type specimens. Diels (in Engl. Jahrb. XXIV, 568) has had recourse to anatomical characters, but, as far as I can judge, these are only of subsidiary value. In any case they would have to be investigated on a much bigger scale than this has been done hitherto, to be of much value in determining species.

In view of the extreme variability of the S.A. species of *Rhus* I have for a number of years given special attention to them in the field. In the year 1924 I had the advantage

* All figures are natural size, unless otherwise stated. The tertiary veins are in most cases drawn in a portion of one leaflet. Hairs are omitted in the majority of drawings.

of inspecting the collections of *Rhus* at Kew and Dahlem-Berlin. Aided by a grant from the Union Research Grant Board, I was enabled to examine these again more carefully in 1927, and I also studied the collections in the Linnean Herbarium and at the British Museum, London. I also had the privilege of examining Thunberg's Herbarium* preserved at Upsala and Jacquin's specimens preserved at Vienna. In addition, I have seen most of the material preserved in S. African herbaria. The herbarium of the S. African Museum was particularly helpful as it contains most of Ecklon and Zeyher's types. Many friends have supplied me with abundant material, and a number of foresters in the Union Department of Forestry have, by instruction of the Chief Conservator of Forests, contributed much live material and many notes. If in spite of all this help, for which I express my very best thanks, my work does not come up to expectations, I can only plead that the nature of the task made a quite satisfactory solution practically impossible, and I can assure all my friends, to whom I owe so much in this connection, that at all events all the material has had earnest attention and consideration.

The drawings in this paper have mostly been executed by Miss Olive Armstrong, by kind permission of Mr. J. Hewitt, Director of the Albany Museum. Much assistance was received from Mr. R. A. Dyer, M.Sc. of the Botanical Survey, and by his permission, Miss G. Britten typed this paper.

There have been six more or less extensive accounts of South African species of *Rhus* published, in which they have been either carefully described or their descriptions have been short, but type specimens are mostly in existence. I refer to (1) Willdenow, Species Plantarum I (1797), which represents the 4th edition of Linnaeus' Species Plantarum ; (2) Thunberg, Flora Capensis ed. Schultes (1823) ; (3) De Candolle, Prodromus II (1825) ; (4) Ecklon and Zeyher, Enumeratio Plantarum Afr. Austr. Extratropicae (1835–37) ; (5) Sonder, in Harvey and Sonder, Flora Capensis I, 504 (1859, 1860) ; and (6) Engler, in De Candolle, Monographiae Phanerogamarum IV (1883).

A few remarks on some of these may not be out of place. Thunberg, who described 29 species, mistook *Rh. laevigata* L. His mistake has been perpetuated until now, and I have been compelled to give it a new name, *Rh. Legati*. His *Rh. spicatum* is *Schmidelia decipiens*, which frequently is even now mistaken for a species of *Rhus*† [it was, e.g. described by Schinz as *Rh. knysniaca* in Vierteljahrschr. d. naturf. Ges. Zürich LX (1910) 238]. *Rh. cirrhiflorum*, *dimidiatum*, *tridentatum*, and *Rh. digitatum* are species of *Rhoicissus*. *Rh. pauciflorum*, *Rh. alatum*, and possibly *Rh. obliquum* are *Hippobromus alata* E. et Z. *Rh. sinuatum* Thunb. is unknown from South Africa, but agrees exceedingly well with an Indian species (*Rh. mysurensis* Heyne).—Ecklon and Zeyher enumerate 48 species of S.A. *Rhus*. An attempt is made by them to arrange them in natural groups, but this must be looked upon as a total failure. They erroneously ascribe hermaphrodite flowers to most of them. The number of species has been unduly increased by them and older names have frequently been erroneously used. Their No. 1110, *Rh. Plukenetiana* E. et Z., which does not appear to have been mentioned by subsequent authors, is *Rh. tomentosa* L. Their reference to one of Plukenet's figures is wrong. This figure represents *Rh. incanum* Mill., as shown by Plukenet's original in the British Museum.

Sonder with his usual minute care and taxonomic insight did a great deal to clear up the synonymy of the species known to him and arranged them in accordance with an artificial key which he constructed. He recognized 53 species. Of the new species described by him I have had to rename his *Rh. tridentata* and have called it *Rh. Fraseri*. His numbers 47 to 52, *Rh. Thunbergii Hook.* (=*Rh. argyrophylla* Presl), *Rh. dispar* Presl, *Rh. concolor*

* See Schonland : The genera *Rhus* and *Crassula* in Thunberg's Herbarium, Arkiv för Botanik XXI. A (1927), No. 16.

† E. Meyer, in Drège exsicc. places it also under *Rhus* and has given it three different names. He also refers to our genus all other South African species of *Schmidelia* ; further he does the same with *Myaris inaequalis* Presl, *Xanthoxylon capense* Harv., and *Sapindus oblongifolius* Sond. as a reference to Vol. I of Harvey and Sonder. Fl. Cap.. will show.

Presl, *Rh. mucronifolia* Sond. (=*Rh. salicifolia* Presl), *Rh. salicina* Sond., *Rh. paniculosa* Sond., were later removed by Engler to the genus *Heeria* Meisn (=*Anaphrenium* E. Mey.) and No. 53, *Rh. longifolia* Sond., to the genus *Protorhus* Engl.

Engler accepted almost all species recognized by Sonder. It goes without saying that this was done after due consideration and, if there was any evidence required, it shows itself in the much more detailed descriptions drawn up by Engler as compared with Sonder. He must have overlooked *Rh. magalismontana* Sond. (a type of which is, e.g. in the Herbarium of the S.A. Museum). He doubtfully referred *Rh. sinuata* Thunb., which Sonder had seen in the Thunberg Herbarium, to *Rh. refracta* E. and Z., and he raised *Rh. dentata* Thunb. var. *puberula* Sond. to specific rank as *Rh. Sonderi* Engl. However, the general agreement is a striking testimony to Sonder's discriminating and painstaking work, but it further proves that our species of *Rhus*, in spite of their enormous range of variability, are on the whole entities recognizable by the trained botanist. Engler in his monograph described some additional varieties of some species and also 14 new species not included in the Flora Capensis. About 20 additional species have been published since the appearance of Engler's monograph. I have seen types and descriptions of all of these with the exception of *Rh. dunensis* Gandoger in Bull. Soc. Bot. de France LX (1913), 119, and *Rh. tumulicola* S. Moore in Journ. of Bot. 1921, LIX, 227. The latter judging from the description appears to be *Rh. Zeyheri*.

Diels, in his essay entitled "Die Epharmose der Vegetationsorgane bei *Rhus* L. § *Gerontogeae* Engl." (in Engl. Bot. Jahrb. XXIV, 568), made an attempt to divide this section into natural groups in which the *Villosa* group formed the centre of nine others. He made, as mentioned before, extensive anatomical investigations, but in the delimitation and treatment of the groups in detail he makes very little use of them except, that he lays very great stress on the absence and, if present, on the nature of the indument which is composed of ordinary and glandular hairs in variable proportions. He also emphasizes the various methods of reduction in leaf-surface. While his results are undoubtedly an advance on our previous knowledge, it will be seen later that I do not agree with them altogether. Diels stated that, with the increase of material, the delimitation of the species, which seemed on the whole to be comparatively easy at the time when Engler wrote his monograph, has become more and more difficult, and he pointed out that some previously described species could not be kept up.

B.—*Distribution*.

Most S.A. species are found on the seaward side of the great escarpment (as defined by Rogers in Botanical Survey Memoir No. 4, 1922, p. 10) with only a few in karroid portions. Many are found in the Transvaal. Some are found in the Basuto highlands, the Orange Free State, and other inland portions of South Africa, but even in parts with comparatively good rainfall which the majority inhabit, there are some which prefer stony dry hillsides. In fact a very intimate knowledge of local conditions is required to judge the relations of climate and structure in this genus. In the arid parts of South Africa some species, such as *Rh. lancea* and *Rh. viminalis* are well known to occur only in such places where their roots can reach ground water, and it is, therefore, not astonishing to find that Cannon found the highest rate of transpiration of Karroo plants in *Rh. viminalis* along stream beds at Matjesfontein. Its leaves are very little protected by a resinous secretion and have no fixed relation to the light (Cannon, W. A., General and physiological features of the vegetation of the more arid portions of Southern Africa, with notes on climatic environment, Washington, 1924, p. 145). On the other hand, there are others which grow in sand-dunes by the sea exposed to physiological drought, e.g. *Rh. Schlechteri*, *Rh. crenata* Thunb., forms of *Rh. mucronata*, etc.

C.—*Habit*.

The majority of South African species of *Rhus* are much branched shrubs from 8 to 10 feet high. A fair number of these may assume an arborescent habit reaching heights of 20 to 30 feet, but only one, *Rh. Legati* (*Rh. laevigata* Thunb. non Linn.), may become a

conspicuous tree with a well-defined trunk reaching a height of 60 to 80 feet. Some, e.g. *Rh. lancea* and *Rh. viminalis*, assume a willow-like habit. A few, e.g. *Rh. rosmarinifolia*, *Rh. discolor*, *Rh. gracillima*, *Rh. Wilmsii*, *Rh. Keetii*, are dwarf shrubs, unbranched or very little branched above ground. The first of these has assumed a somewhat heath-like habit with its narrow leaflets recurved at the margin. The last four occur in grassveld and in the last two especially an approach to a grass-like habit can be discerned.

Some species are always thorny, e.g. *Rh. longispina* E. et Z. A number of others are often thorny, e.g. *Rh. pyroides*. One often finds also dwarfshoots forming a transition between ordinary shoots and thorns. In some species thorns are only found in seedlings and coppice-shoots, e.g. regularly in *Rh. Legati*. The vegetative organs vary considerably in many species. Many species form coppice shoots readily and these shoots at first are often very different from ordinary shoots. The variations in the ordinary shoots are usually shown especially in the leaves, which will be referred to presently.

D.—*The Leaves.*

The majority of species have well-developed petioles, which are often subsemiterete, canaliculate above. They are often slightly edged, and when this is readily discernible they are described as winged.

Usually the leaves are trifoliolate. Leaves with five leaflets are the rule in *Rh. montana* Diels (as far as the scanty material shows), and are occasionally found in *Rh. MacOwani* Schonl. Less than three leaflets are also occasionally met with.

In some species, e.g. *Rh. tomentosa* and *Rh. Legati*, the leaflets have petiolules, but usually the leaflets are sessile. Ovate and obovate outlines, with a cuneate base, predominate, but narrowly linear and lanceolate shapes are found in a few species which, as Diels rightly remarks (l.c. 594), are the final products of certain tendencies of evolution. Unfortunately the leaflets yield the most important, though not the only characters, on which the delimitation of species in this genus can be based, and it must be very annoying to anybody who wants to study the genus to find a great vagueness in the descriptions of even their shape. The consistency of the leaflets is more constant, but cannot always be clearly seen in dried specimens. In one case, *Rh. carnosula* Schonl., the leaflets are slightly fleshy, though when dried they appear coriaceous. The margin of the leaflets is often more or less characteristic, but teeth (not always of the same shape) may be found in species which have usually an entire margin and, not only in different individuals but even on the same branch, differences in shape and margin of the leaflets may be found in many species.

The enormous plasticity in the shape of the leaflets may be due to *Automorphosis* dependent on internal causes which we cannot trace, or, in other words, to variations in the Darwinian sense. However, in some cases they are clearly due to hybridisation,* though in many others hybridisation may be safely ruled out of court.

The nervation of the leaflets is fairly characteristic for the different species, and has been indicated on most of the illustrations of leaves which accompany this paper. I have distinguished in the descriptions between (*a*) midrib, (*b*) lateral veins which are often slightly branched, and (*c*) tertiary veins, the finer ultimate ramifications. The last are often not visible with the unaided eye or with the aid of a lens. They may even be absent altogether. The reticulation may be coarse as in *Rh. mucronata* and *Rh. nebulosa* Schonl., or it may be fine-meshed, but there are gradations which cannot always be expressed in the descriptions. The trichomes found on the leaflets (as well as on the petioles, branchlets, and inflorescence) are to a certain extent of taxonomic value, but in certain cases, e.g. in *Rh. mucronata* they must be ignored as a means of specific distinction. Already Diels stated (l.c. 605) this somewhat as follows :—The covering of trichomes cannot be traced to exogenous conditions. There is no way to judge which circumstances can effect the quality of the indument. "We can only observe that within closely related species the combination of ordinary hairs and glandular hairs varies enormously quantitatively. Espe-

* For supposed hybrids see pages 9, 23, 29, 37, 41, 42, 43, 47, 54, 58, 66, 75, 108, 112.

cially is this the case in *Rhus* § *Villosa*. Sometimes we see hairs and glands approximately equally represented. Sometimes hairs preponderate especially in the more xerophilous forms, which inhabit the eastern interior." (I cannot follow his reasons in the next remarks, which seem, on the one hand, to indicate a relation of the hairy covering to the rainfall, but, on the other hand, contradict it.) Very hairy, subglabrous and glabrous forms of *Rhus mucronata* are found almost side by side on Table Mountain. The most villous form known to me from South Africa is *Rh. Ernesti* Schonl. found at Barberton. Numbers of species have very hairy young leaves, etc., but become more or less glabrous when adult. Diels continues :—" In contrast to the hairs the glands (of which he illustrates some on Taf. XIV) have a firmer existence. In thousands of specimens where the former are in the process of dying or have disappeared altogether, the glandular trichomes remain in undiminished number. Even if the lamina decreases in size, they become more numerous per unit of area and there result races with chiefly glandular covering. Which are the conditions that favour such a development is impossible to me to even conjecture." Predominance of glands is especially pronounced in the *Lucida* group. That in some cases it is associated with habitat in which the plants are subjected to physiological drought, as in sand dunes or to arid conditions in the interior, seems to be evident. The glands frequently secrete a resinous substance, which when dry and thin layered makes the leaflets look " varnished " or when thick it may become grey or powdery, but this again can only very cautiously be used for specific discrimination. Thus, Marloth says in " Das Kapland " (1908), 324, with reference to *Rh. mucronata* and *Rh. lucida*, " on the leaves resin is rarely seen near Capetown, but constantly in the Little Karroo and other dry parts. On the other hand, *Rh. glauca* is richly provided with resin, even in the extreme South-West. The young leaves are covered with a soft, sticky varnish which dries in summer and forms a white crust. Several other species of *Rhus* (as well as a *Psoralea* and *Conyza ivaefolia*) protect themselves in the same manner."

E.—*Inflorescences.*

The inflorescences are panicles, sometimes poorly branched, in which case they are lax as, e.g. in *Rh. mucronata* and *Rh. pyroides* Burch. (non auct. al.). In other cases they are richly branched and bear an abundance of flowers as, e.g. in *Rh. MacOwani* and *Rh. Legati*. They may be axillary, usually in the axils of the upper leaves, or terminal. Usually both axillary and terminal occur in the same species. These and similar characters are often of great assistance in distinguishing allied species, but should be employed cautiously as sometimes male and female differ in these points. The pedicels are usually about 1 mm. long, though somewhat longer ones occur and sometimes they are shorter, the flowers then forming glomerules. The floral bracts are short and usually narrowly lanceolate.

F.—*Flowers.*

The flowers are typically unisexual, the plants dioecious. Truly bisexual flowers occur, but only as exceptions in usually unisexual species. Ecklon and Zeyher's statements to the contrary are not based on facts. The flowers are usually pentamerous, but variations in the number of floral parts occur occasionally. The calyx has in the usual pentamerous flowers 5 segments, which in some species are not equal. There are 5 petals, usually oblong-ovate and greenish-yellow or whitish. Then follows a disk which is usually 5-crenate. Very often it is slightly crisped, giving the appearance of 10 crenations, but sometimes the disk is actually 10-crenate. In male flowers there are 5 stamens and often not a trace of a gynaecium. On the other hand, the female flowers exhibit usually 5 staminodes. The gynaecium has a more or less globose ovary with 3 short, separate, filamentous styles.

On the whole, there is such a want of differentiation in the structure of the flowers that it is difficult to utilize their characters for taxonomic purposes. Even the size, though always small, varies in the same species, yet when used with discretion, size can sometimes be used as an aid in discriminating some allied species. Generally the length of the petals is 1¼ to 1½ mm., as e.g. in *Rh. MacOwani* Schonl. ; sometimes it reaches 2 mm. as, e.g. in *Rh. muoronata* Thunb.

G.—*The Fruit.*

The fruit is a drupe with fleshy mesocarp, which, however, in some species dries up more or less when the drupes ripen, while in others it remains juicy for a long time. In *Rh. incisa* var. *obovata* the old drupes split open exposing the pyrena and we thus find here a transition to a capsular fruit. The pyrena is usually distinctly compressed even in globose fruits. The colour of the drupes is often greenish, sometimes red (as in *Rh. Legati* and *Rh. dentata*), sometimes brown. The shape is often globose or subglobose, in some species it becomes occasionally or in others always asymmetrical. Usually the drupes are quite smooth and glabrous. In the *Tomentosa* and *Populifolia* groups hairy drupes are found, in the latter also verrucose drupes. In the *Populifolia* group tricuspidate drupes occur, through the retention, hardening, and slight thickening of the styles. This is also occasionally found in other groups.

H.—*Uses.*

Some species as, e.g. *Rh. crenata* help greatly in fixing coastal sanddunes, but I am not aware that this property has been used by planting these species. Many species favour streambanks, e.g. *Rh. mucronata, Rh. MacOwani, Rh. dentata,* and in the dry parts of South Africa, *Rh. lancea, Rh. viminalis,* and other members of the *Lancea* group. They thus prevent useful soil being swept away. On the other hand, a great deal of damage has been done, where wood is scarce, by the wholesale destruction of these species for firewood and other purposes. It is very desirable that extensive experiments should be made to see whether they can be restored.

The bark of some species is used for rough cordage, hence the name Taaibosch.

The wood of most species is tough (frequently of a reddish colour), and various species, e.g. *Rh. mucronata, Rh. lucida, Rh. pyroides,* and even *Rh. Engleri,* are used for making kerries and pickhandles. Whipsticks are made of *Rh. mucronata.* A systematic examination of these woods is not available. They are usually passed by, because their trunks rarely reach proper timber-size, and they are often found where better timber-trees are available. Even *Rh. Legati* (*Rh. laevigata* Thunb. non Linn.), which grows into a large tree is not favoured by sawyers, though its wood is often used for wagon work. According to Pappe, in "Sylva Capensis" (1869), the thicker and longer branches of *Rh. viminalis* (Karee wood) are used as spars in thatching houses and also for wagon tents, as they bend easily without breaking; the younger twigs for bows.

In former years the bark of *Rh. lucida* (Taaibosch or Cape Sumach) and *Rh. tomentosa* was used for tanning purposes. Various species are locally used as hedge-plants; I would especially recommend *Rh. erosa,* which has a very striking appearance and should clip well. Goats and Persian sheep have been noticed by me to eat the foliage of *Rh. undulata* and *Rh. longispina,* and others are also reported to be eaten by stock, but as pasture plants they will never be of much consequence except as a last resort in the most arid portions of South Africa. Various species are reported to have edible drupes, but to appreciate this statement one must know what other astringent fruits South African children will eat and apparently enjoy. There is no hope that any of our species will yield a fruit that will be generally acceptable.

I.—*The Phylogeny of South African Species of Rhus.*

D. H. Scott [in Progressus Rei Botanicae (1907), 139] rightly stated that the determination of the actual course of descent is the ultimate or chief object of the scientific systematist.

The course of evolution in South African species of *Rhus* may be here and there traced or, more accurately speaking, surmised, but its cause and its mechanism are for the present quite hidden from us. At first sight the cause in many cases seems to be laid bare by the fact that forms, such as we find, e.g. in the *Tomentosa* group, which deviate much from the supposed original type, have many characters which have enabled them to adapt themselves to a drier climate or to greater extremes of climate than the typical forms. They have become more xerophytic, and it is evident that much of the development of South African species of *Rhus,* as in so many other South African plants, has taken place in the direction from more mesophytic types to more and more xerophytic types of the vegetative organs

by reduction in the breadth of the leaflets, thickening of the cuticle, exudation of resinous substances, recurving of the lamina in narrow leaflets, sunk stomata, etc. However, it is quite plain that these and similar characters, which enable some species to exist in some of the most arid parts, are not directly caused by the climate. This statement cannot be proved accurately, though it is significant that, e.g. the densely villous *Rh. mucronata* var. *villosa* and *Rh. Ernesti* occur in parts with a considerable amount of rainfall. We find one character, especially though not exclusively, developed in the *Populifolia* group, which is only found in species of dry localities. I refer to the retention of the styles and their slight thickening in these species. This is an evolutionary tendency for which no reason can at present be assigned. Another evolutionary tendency, a hairy covering of the fruit has found its clearest expression in the *Tomentosa* group, which, however, are found in localities where other species with glabrous drupes are found.

How difficult it is to correlate the conditions under which species with diverse characters grow may be illustrated by the following example : Near my home, Aylesby, near Grahamstown, there are growing wild, under apparently identical conditions, *Rh. MacOwani, Rh. undulata, Rh. lucida, Rh. longispina, Rh. incisa* var. *obovata*. Half a mile away *Rh. tomentosa* is found under apparently the same conditions.

The clearest indication that characters which are most useful in dry localities are not necessarily caused by arid conditions is given by the thorny species, for the most formidable thorns are found in seedlings and coppice shoots of *Rh. Legati,* a species which is never found in arid parts or dry localities. To quote another instance :—*Rh. longispina* and *Rh. undulata* are often growing side by side, the former armed, the latter unarmed. Both are browsed upon like many other species of *Rhus* by goats and other herbivorous animals.

The extreme innate variability of the leaves of many South African species of *Rhus* has already been referred to. In some of these cases at all events, hybridization seems to be clearly excluded, in many others it is not likely to be the cause of variation, yet there can be no doubt that some species, e.g. *Rh. dentata* hybridize freely.

Only one with an experienced eye can recognize the hybrids, or rather he can *guess* that he is dealing with hybrids, because proof could only be furnished by very lengthy cultural and cytological investigations.

Diels has assumed that his *Villosa* group has formed the starting point for all other African groups of the genus. He has made out a strong case for this assumption and we have accepted it. His *Villosa* group corresponds largely to the *Mucronata* group of the present paper. Diels imagines that the *Rhus* § *Gerontogeae,* which are found in the whole of Africa, parts of Makaronesia, South Arabia, Syria, British East Indies and territories adjoining in the North East, Socotra and the Comore Isl., but not in Madagascar, have entered Africa in the North. He draws an interesting parallel of their origin and migrations with that of the Antelopes. The *Mucronata* group covers almost the whole of the distribution of the section, but already the *Natalensis* group, which it is assumed has been derived from it, has almost as wide a distribution, though in South Africa it does not go beyond districts which have a subtropical climate. There are an enormous number of forms in Tropical Africa which have been (to my mind wrongly) referred to *Rhus villosa* L.f., while other distinct tropical species also belong to Diels' *Villosa* group. *Rh. natalensis* Bernh. (*Rh. glaucescens* Rich.) is also much differentiated in Tropical Africa, but the material of *Rhus* hitherto collected in Tropical Africa, though very large is mostly defective and usually not accompanied by sufficient notes. It cannot be too often pointed out that scraps taken from a tree or shrub with nothing but the locality are practically useless for taxonomic purposes or at all events give more trouble than they are worth, besides often creating confusion. Starting from the *Mucronata* and *Natalensis* groups further differentiation took place already in Tropical Africa while the genus spread southwards, but the largest differentiation clearly took place after it reached South Africa.

I have arranged the South African species into twelve groups. Of these, in addition to the *Mucronata* and *Natalensis* groups, the *Lancea* and *Discolor* groups extend a good deal

into Tropical Africa; some others also are not strictly confined to Temperate South Africa, though their origin may be looked for at all events considerably south of the equator.

The *Discolor*, *Tomentosa*, *Populifolia*, and *Horrida* groups are more removed from the original type than the others, and may be the youngest groups. In all of them a xerophytic tendency is clearly discernible, especially in the three last ones. The *Discolor* group shows relations to the *Tomentosa* and *Populifolia* groups, while the *Horrida* group may have been derived from the *Lancea* group. While these general relations can be observed, I fail to see how a more detailed evolutionary scheme can be presented from available data.

Diels (l.c. 644) says:—"The gerontogaeous species of *Rhus* furnish as it were a type, which in the generative sphere has been stabilized since immemorial times, but whose life-energy is represented by the elasticity of its vegetative organs in response to external influences. Therefore, according to him, one succeeds here in picturing much more easily the conditions for one kind of polymorphism, the epharmonic one, than is possible in the majority of objects, where the greater complexity of all circumstances forces itself at once on the observer. Thus, the *Rhus* § *Gerontogeae* furnish an interesting instance, how in many cases epharmosis, here equivalent with what is usually known as formation of species, has been brought about."

Now, in the first place, the epharmosis of the vegetative organs of our species of *Rhus* is not the only, though the most important point in their differentation. Further, the detailed account of the epharmosis of the vegetative organs, while often most interesting, and here and there no doubt rightly indicating the course of evolution, is to my mind wrongly interpreted or at least doubtful in other cases, and with the more detailed knowledge now available, one may say that the attempt at getting at the cause of this evolution is a failure and the mechanism of evolution has not been touched upon. In fact, though the study of the genus attracted me from a genetic point of view especially, I must frankly confess that I have come to the conclusion that morphological (including anatomical), geographical, and ecological facts are not sufficient to give a clear insight into the evolution of our species of *Rhus*. Perhaps cultures on a large scale and cytological investigations, neither of which I have touched, will help to bring about the desired result. Under the circumstances I do not feel justified in following Diels' example by trying to form as it were a genealogical tree of the species. At the same time I can recommend Diels' account to students of the genus, who cannot fail to be stimulated by it, and who will find many interesting facts in it which I have not included in this paper.

While thus, to recapitulate, the evolution of our species of *Rhus* for the present largely evades our grasp, it seems evident that the majority of the South African species have been evolved *in* South Africa, and this, as stated before, applies also to some of the groups. A separation of the *Mucronata* and *Natalensis* groups evidently has, however, taken place long before the genus reached South Africa.

To show the probable *relationship of the groups* represented in South Africa the following scheme has been drawn up:—

Mucronata. *Natalensis*. . . . . *Lancea*. . . . . *Horrida*.

Dentata. — *Natalensis* → *Discolor*. . . . . *Tomentosa*.

Refracta. *Ecklomana*. — *Tomentosa* → *Populifolia*.

Refracta → *Lucida*. → *Legati*.

SHORT DESCRIPTIONS OF GROUPS AND KEYS OF THE SPECIES.

MUCRONATA group.

Shrubs or rarely trees, unarmed or rarely thorny, often more or less hairy, but the hairs in many species become less or disappear altogether on the adult leaflets and other

adult organs. Petioles canaliculate above, rarely slightly winged. Leaflets membranous or rarely subcoriaceous, generally entire, more or less obovate, rarely sublanceolate, tertiary veins generally distinct (unless obscured by hairs) and reticulate. Panicles lax or densely multiflowered. Drupes glabrous, subglobose or slightly compressed.

DISTRIBUTION: Widely spread in South Africa, absent in the arid north-western and western parts; also widely spread in Tropical Africa.

A.—Panicles lax, shorter or slightly longer than the leaves.

(*a*) Leaflets oblong-lanceolate or oblanceolate.

α Leaflets at first villous, later pilose.......... 11. *Rh. Rudatisii* Engl.

β Leaflets glabrous.......................... 1. *Rh. mucronata* Thunb., B. *laevigata* (L.) Schonl.

(*b*) Leaflets broad, usually obovate.

α Adult leaflets densely villous.

1. Hairs fairly uniform all over............ 4. *Rh. mucronata* Thunb., E. *villosa* (L.f.) Schonl.

2. Midrib and the larger veins covered with lighter, straight hairs................. 2. *Rh. Ernesti* Schonl.

β Adult leaflets more or less hairy or glabrous.

1. Drupes 5–5·5 m.m. in diam............ 1. *Rh. mucronata* Thunb.

2. Drupes 3–3½ mm. in greatest diam.

x. Mature leaflets quite glabrous, coriaceous.

o. Branchlets subterete........... 10. *Rh. dura* Schonl.

oo. Branchlets angular.......... 9. *Rh. krebsiana* Licht.

xx. Mature leaflets more or less covered with fine, often appressed hairs.

o. Tertiary veins very coarsely reticulate. Leaflets subcoriaceous. 8. *Rh. nebulosa* Schonl.

oo. Tertiary veins delicately reticulate. Leaflets membranous.

† Petioles less than half the length of the leaflets...................... 6. *Rh. pyroides* Burch.

†† Petioles slender, more than half the length of the terminal leaflets.... 7. *Rh. Baurii* Schonl.

B.—Panicles densely multiflowered, terminal much longer than the leaves and greatest diam. of fruit about 3 mm.

(*a*) Leaflets oblong or obovate, acuminate, cuneate (the cuneate base often at least half the length of the leaflet), often with a few gross mucronulate teeth at the apex. Petiole 1–2 cm. long.............. 4. *Rh. Fraseri* Schonl.

(*b*) Leaflets ovate or obovate, obtuse, acute or acuminate, generally entire.

α Petioles about 1·5 cm. long................. 3. *Rh. MacOwani* Schonl.

β Petioles 2·3–4 cm. long..................... 5. *Rh. intermedia* Schonl.

DENTATA group.

Glabrous or hairy shrubs. Petiole canaliculate above, rarely slightly winged. Leaflets membranous or coriaceous, rarely slightly fleshy, obovate, ovate, oblong-cuneate or cuneate, usually in the upper portion crenato-dentate. Tertiary veins reticulate. Panicles multiramose, lax or densely multi-flowered, the axillary shorter than the leaves, the terminal longer.

DISTRIBUTION : Chiefly on the edges of open bush and forests and in stream-bank scrub in the coast districts from the Zitzikamma to Swaziland, in the mountainous parts of south-eastern Cape Province and Natal, extending along the Drakensberg to the northern Transvaal, ; also in the eastern Orange Free State.

A.—Quite glabrous. Leaflets oblong or obovate, more or less grossly dentate in the upper part, slightly fleshy when fresh. Drupe about 5 mm. in diam........................ 13. *Rh. carnosula* Schonl.

B.—Branchlets pilose. Leafflets oblong-cuneate or obcuneate, coriaceous, upper part more or less crenato-dentate..... 14. *Rh. Rogersii* Schonl.

C.—Branchlets glabrous or subglabrous. Leaflets oblong-ovate, undulate, entire.................................. 15. *Rh. ntsubanensis* Schonl.

C.—Quite glabrous or more or less hairy. Leaflets membranous, very variable in shape, usually obovate-cuneate and more or less dentate, if entire much smaller than in *Rh. ntsubanensis*. Drupe about 4 mm. in diam................. 12. *Rh. dentata* Thunb.

REFRACTA group.

Richly branched, usually unarmed shrubs with comparatively small leaves. Petioles not winged, rarely slightly exceeding 1 cm. in length. Leaflets membranous or subcoriaceous, ovate, obovate or oblong, more or less hairy when young, subglabrous or glabrous when adult. Terminal leaflets rarely exceeding 2·2 cm. in length. Panicles lax, rarely multi-flowered. Drupe, where known, subglobose, fleshy, glabrous (in one species tipped with the styles).

DISTRIBUTION : Coast districts of South Africa from the Cape Peninsula to Natal and mountainous parts of south-eastern Cape Province and Natal, slightly extending into the Orange Free State and the Transvaal. One species in the South-West Protectorate,.

Of the species belonging here, Diels has only classified *Rh. crenata*. He places it (l.c. 630) into his *Crenata* group with *Rh. natalensis*. This, to my mind, is an artificial association, though in both glandular hairs are predominant on the leaflets, the margins of which are crenate. The group, as here constituted, is very close to the *Mucronata* group. *Rh. refracta* especially can hardly be kept out of it. The *Refracta* group might also be united with the *Eckloniana* group.

A.—Petioles about 2 mm. long. Leaflets obovate-cuneate, tricrenate at the blunt apex......................... 19. *Rh. crenata* Thunb.

B.—Petioles 5 or more mm. long.

(*a*) Adult leaflets greyish pubescent.................. 18. *Rh. Dinteri* Engl.

(*b*) Adult leaflets dark green above, whitish or fulvous tomentose below............................... 21. *Rh. divaricata* E. et Z.

(*c*) Adult leaflets dark green above, paler green below.

α Leaflets entire, oblong or elliptic-lanceolate, terminal 2–3 cm. long...................... 17. *Rh. fastigiata* E. et Z.

β Leaflets obovate-cuneate, usually entire, rarely crenulate towards the apex, terminal 1·2–2·2 cm. long, somewhat larger in specimens growing near the sea.................... 16. *Rh. refracta* E. et Z.

γ Leaflets elongated obovate-cuneate, tridentate or emarginate at the blunt apex, terminal 2–3 cm. long............................... 20. *Rh. Pentheri* Zahlbr.

δ Leaflets broadly obovate or obovate-elliptical, entire, terminal about 1·3 cm. long........ 22. *Rh. rupicola* Wood et Evans.

LEGATI group.

Shrubs or trees, mostly glabrous in all mature parts. Petioles not winged. Leaflets membranous or subcoriaceous, usually quite entire, obovate or obovate oblong, acuminate, narrowed at the base, sometimes petiolulate, tertiary veins reticulate. Panicles large and much divided, multiflowered in one species, very lax and usually smaller than the leaves in the two others. Drupes shining, glabrous, subglobose or globose.

DISTRIBUTION : *Rh. Legati* (*Rh. laevigata* Thunb. non Linn.) is found in all forest patches and often in stream-bank bush from Swellendam to Natal and the northern Transvaal; the two others are restricted to the eastern parts of the Drakensberg and the neighbourhood of Pretoria.

Diels (l.c. 638) refers all three species to his *Laevigata* group, but also puts under this group a number of other species which I have placed elsewhere.

A.—Perfectly glabrous or rarely with slightly pilose branchlets.
- (*a*) Leaflets green or partly reddish, slightly undulate, the terminal 7–13 cm. long........................ 23. *Rh. Legati* Schonl.
- (*b*) Leaflets glaucous, the terminal 2–3 cm. (rarely up to 6 cm. long).................................. 25. *Rh. Zeyheri* Sond.

B.—Branchlets at first villous, later glabrescent. Leaflets green, the terminal 2·5–4 cm. long.................... 24. *Rh. transvaalensis* Engl.

LUCIDA group.

Much branched unarmed shrubs, usually with predominance of glands over hairs. Petioles channelled above and more or less winged. Leaflets often "varnished", subcoriaceous or coriaceous, rarely membranous, obovate-cuneate, lanceolate-cuneate or obcordate-cuneate, entire or rarely dentate, with lateral veins distinct, butt ertiary veins rarely visible. Panicles lax, shorter or slightly longer than the leaves.

DISTRIBUTION : Common in open bush and on the edges of forest in the coast districts from south-western Cape Province to Natal and Gazaland. One species widely spread in the more arid portions of western and central portions of South Africa extending to the South-West Protectorate.

Diels (l.c. 632) has placed most of the species here united into his *Lucida* group, to which he also refers *Rh. horrida*, *Rh. longispina* and *Rh. cuneifolia*. On the other hand, he placed *Rh. celastroides* Sond., which, in my opinion, is only a variety of *Rh. undulata*, into his *Pyroides* group next to *Rh. mucronata*.

A.—Leaflets lanceolate-cuneate, acute or emarginate, entire, rarely ovate, dentate, membranous in the coastal forms.. 32. *Rh. undulata* Jacq.

B.—Leaflets obcordate-cuneate.
- (*a*) Greatest diam. of drupe about 3 mm............... 32. *Rh. undulata* Jacq. var.
- (*b*) Greatest diam. of drupe about 5 mm............... 31. *Rh. glauca* Desf.

C.—Leaflets more or less obovate-cuneate.
- (*a*) Leaflets practically sessile......................... 27. *Rh. Schlechteri* Diels.
- (*b*) Leaflets distinctly petioled.
  - *α* Petals $1\frac{1}{4}$–$1\frac{1}{2}$ mm. long.
    1. Petioles slightly winged. Leaflets subcoriaceous with lateral veins delicate, though distinct...................... 26. *Rh. lucida* L.
    2. Petioles broadly winged. Leaflets coriaceous, lateral veins usually prominent on both surfaces.................... 30. *Rh. scytophylla* E. et Z.

β **Petals about 2 mm. long.**

1. Glabrous. Leaflets with thickened white revolute margin...................... 29. ***Rh. albomarginata*** **Sond.**
2. Branchlets, panicles, etc., hairy......... 28. ***Rh. africana*** **Mill.**

ECKLONIANA group.

Shrubs, one species dwarf, rarely small trees, usually unarmed and usually with comparatively small leaves. Petioles subterete or slightly winged. Leaflets membranous or subcoriaceous, glabrous or pilose, entire or slightly crenato-dentate, oblong, lanceolate or oblong-lanceolate rarely exceeding 3 cm. in length. Panicles lax, shorter or longer than the leaves. Drupes glabrous, subglobose, shining.

DISTRIBUTION: Transvaal, one species also in the Cape Province from the Uitenhage to the Albany District.

Diels (l.c. 627) placed *Rh. Engleri* Britt. (=*Rh. incana* Engl.) into his *Pyroides* group, without, however, indicating close relationships with any other species. *Rh. ecklontana* Sond. was not classified by him.

A.—Branchlets and leaflets greyish pilose. Drupe about 3 mm. in diam.. 34. *Rh. Engleri* Britt.

B.—Branchlets pubescent. Leaflets deep green above, paler below, sparsely pilose. Drupe about 3 mm. in diam.... 35. *Rh. eburnea* Schonl.

C.—Branchlets and leaflets glabrous or more or less pubescent. Leaflets deep green above, slightly paler below, often folded along the midrib. Drupe 5·5–6 mm. in diam.......... 33. *Rh. eckloniana* Sond.

NATALENSIS group.

Shrubs, rarely small trees, often with more or less greyish or glaucous foliage. Petioles subterete or broadly canaliculate above. Leaflets subcoriaceous, generally more or less oblong, rarely ovate or obovate, almost always crenate, glabrous or more or less pubescent. Tertiary veins rarely distinctly reticulate, often not visible. Panicles generally lax and not exceeding the length of the leaves or slightly longer. Drupes glabrous, shining, in two species sometimes retaining the styles (compare *Populifolia* and *Horrida* groups).

DISTRIBUTION: South-West Protectorate, Bechuanaland, Transvaal, coast of temperate South Africa from East London to the Tropics, and strongly represented in many parts of Tropical Africa.

Diels places *Rh. natalensis* into his *Crenata* group and *Rh. Marlothii* into his *Damarenses* group.

A.—Leaflets ovate or obovate, greyish, softly pubescent..... 40. *Rh. commiphoroides* Engl. et Gilg.

B.—Leaflets oblong-cuneate, dark green above, glabrous..... 36. *Rh. natalensis* Bernh.

C.—Leaflets obovate oblong or sublanceolate or oblanceolate, often glaucous, puberulous or glabrous.

(*a*) Drupe strongly compressed, often asymmetrical and sometimes with persistent styles............... 39. *Rh. Marlothii* Engl.

(*b*) Drupe subglobose, c. 3·5 mm. in diam.............. 37. *Rh. Simii* Schonl.

(*c*) Drupe subglobose, sometimes retaining the styles, c. 4 mm. in diam.......................... 38. *Rh. spinescens* Diels.

LANCEA group.

Shrubs or small trees, usually glabrous or subglabrous, mostly unarmed. Branchlets generally slender, rarely whole plant slender and almost unbranched. Petioles canaliculate,

sometimes slightly winged. Leaflets linear or lanceolate-cuneate, rarely oblong, sometimes slightly falcate, entire, dentate or crenate, when mature generally glabrous or subglabrous. Panicles lax. Drupes glabrous, subglobose, sometimes slightly compressed or depressed.

DISTRIBUTION: Chiefly in the Transvaal and Natal (above 3,000 feet), mountains and hilly parts of south-eastern Cape Province, and through the arid interior parts of South Africa to Clanwilliam and Namaqualand, one species extending to Tropical Africa.

Diels includes *Rh. ciliata* in his *Pyroides* group (l.c. 627) and *Rh. gracillima* in his *Tomentosa* group (l.c. 613); the other members of the *Lancea* group, as far as they have been classified by him, he places into his *Laevigata* group (l.c. 638)—*Rh. viminalis* is allied to *Rh. retinorrhoea* Steud., a Tropical African species.

A.—Slender, almost unbranched shrublets.
- (*a*) Petioles 5–7 mm. long............................ 51. *Rh. gracillima* Engl.
- (*b*) Petioles 2–5 cm. long.
  - *α* Leaflets suddenly contracted at the apex, lateral veins prominent on both surfaces.......... 52. *Rh. Wilmsii* Diels.
  - *β* Leaflets acute at the apex, lateral veins a little prominent or more often immersed......... 53. *Rh. Keetii* Schonl.

B.—Much branched shrubs or trees.
- (*a*) Margin of leaflets crisped and sometimes slightly and irregularly dentate............................ 46. *Rh. crispa* Harv.
- (*b*) Leaflets not crisped.
  - *α* Margin of the leaflets eroso-dentate.......... 49. *Rh. erosa* Thunb.
  - *β* Margin of the leaflets serrato-dentate, leaflets obovate oblong or oblong................ 50. *Rh. Bolusii* Sond.
  - *γ* Margin of leaflets with a blunt tooth at the end of each lateral vein......................... 44. *Rh. Gueinzii* Sond.
  - *δ* Margin of leaflets irregularly and usually sparsely crenato-dentate.......................... 43. *Rh. Gerrardi* Harv.
  - *ε* Margin of leaflets entire.
    - 1. Leaflets sessile.
      - x. Branchlets subvillous. Leaflets oblong or obovate, when mature sparsely pilose.................. 45. *Rh. microcarpa* Schonl.
      - xx. Quite glabrous or with puberulous branchlets. Leaflets linear or lanceolate, rarely oblong, glabrous or puberulous, rarely exceeding 2·5 cm. in length...................... 47. *Rh. ciliata* Licht.
      - xxx. Quite glabrous. Leaflets narrowly linear, often falcate, the terminal 3·5–6 cm. long................. 48. *Rh. dregeana* Sond.
    - 2. Leaflets petiolulate, quite glabrous or sparsely hairy.
      - x. Terminal leaflets 4–8 cm. long..... 42. *Rh. viminalis* Vahl.
      - xx. Terminal leaflets 9–12 cm. long.... 41. *Rh. lancea* L.f.

HORRIDA group.

Squarrose or erect, thorny or unarmed shrubs, with young parts covered with glandular, often red, hairs or tomentose. Petioles winged or margined. Leaflets coriaceous or subcoriaceous, obovate-cuneate or linear-cuneate, entire. Panicles lax, usually shorter than the leaves. Drupes glabrous, subglobose or oblique, often crowned with the hardened styles.

DISTRIBUTION: One species in the semi-arid parts of the coast districts from Swellendam to East London, penetrating inland to Graaff-Reinet, two in Namaqualand and Bushmanland, one in the Transvaal.

Diels (l.c. 632) places *Rh. longispina* next to *Rh. lucida* in his *Lucida* group, while *Rh. horrida* was placed by him in the same group next to *Rh. rigida*, which he considers as derived from *Rh. scoparia*. I do not think these relationships hold good. *Rh. longispina* and *Rh. horrida* seem to be closely related. The former again appears to be related to *Rh. ciliata* Licht. (in which ordinary hairs are often absent), and thus there would be established a connection with the *Lancea* group. *Rh. rigida* has been placed in the *Horrida* group, because like the two previously mentioned species it is also without ordinary hairs, though the glandular hairs are not so conspicuous. Its drupe bears the thickened and hardened styles, as is often the case in *Rh. horrida* and *longispina* (compare also the *Populifolia* group). In its vegetative organs it approaches closely some forms of *Rh. magalismontana*, but I am somewhat doubtful whether this should have been included here, because its drupe does not bear the styles and the young parts are shortly tomentose. Diels placed it (l.c. 627) as *Rh. burkeana* next to *Rh. ciliata* in his *Pyroides* group.

A.—Young parts shortly tomentose, drupe not bearing the styles.

Unarmed shrub.. 57. *Rh. magalismontana* Sond.

B.—Young parts glandular.

(*a*) Erect, rigid, unarmed shrub. Petioles narrowly margined. Leaflets cuneate-lanceolate or lanceolate, terminal 4–5 cm. long.................... 56. *Rh. rigida* Mill.

(*b*) Squarrose, usually thorny shrubs. Petioles usually distinctly winged.

α Terminal leaflets 4–8 mm. long.............. 54. *Rh. horrida* E. et Z.

β Terminal leaflets 1–5 cm. long (usually about 2·5 cm.)................................ 55. *Rh. longispina* E. et Z.

DISCOLOR group.

Small, unarmed, poorly branched shrubs, one species more or less tomentose, the other glabrous. Leaflets subcoriaceous, linear-lanceolate, lanceolate or oblong, rarely obovate, always more or less cuneate at the base, entire or sparingly toothed. Lateral veins numerous and often very conspicuous. Panicles dense or lax, shorter or slightly longer than the leaves. Drupes subglobose, sometimes puberulous when young.

DISTRIBUTION: Amongst grass in the mountains of south-eastern Cape Province, Transkei, Pondoland, Natal, Drakensberg Range, Orange Free State, Transvaal.

Diels (l.c. 614) placed *Rh. discolor* into his *Tomentosa* group. The group includes some species found in Tropical Africa.

A.—Leaflets (at least on the under side) tomentose......... 58. *Rh. discolor* E. Mey.

B.—Leaflets glabrous...................................... 59. *Rh. pondoensis* Schonl.

TOMENTOSA group.

Unarmed shrubs (some dwarf) or small trees. Petioles subterete. Leaflets tomentose on the under side, glabrous or subglabrous when mature on the upper, generally subcoriaceous, elliptical, ovate, obovate, linear or linear-lanceolate, entire or slightly dentate or pinnatifid, sometimes petiolulate. Panicles longer than the leaves, densely multiflowered. Drupes villous or densely greyish or fulvous tomentose (very rarely glabrous), subglobose or somewhat oblique.

Distribution: Hills of the coast districts from Namaqualand to the Transkei, but mainly south-western.

Diels (l.c. 613) places all the species here enumerated into his *Tomentosa* group, to which he also refers a number of other species which I have excluded.

A.—Leaflets narrowly linear or linear-lanceolate, entire or with one or two sharp teeth.............................. 63. *Rh. rosmarinifolia* Vahl.

B.—Leaflets lanceolate or narrowly elliptical............... 61. *Rh. angustifolia* L.

C.—Leaflets more or less ovate or obovate in outline, rarely elliptical.

(*a*) Leaflets entire or above the middle, more or less coarsely, serrate. Drupes greyish tomentose............. 60. *Rh. tomentosa* L.

(*b*) Leaflets more or less pinnatifid with obtuse lobes or nearly entire with small triangular often obtuse teeth, rarely quite entire. Drupes villous...... 62. *Rh. incisa* L.f.

POPULIFOLIA group.

Unarmed shrubs. Petioles subterete, slightly canaliculate above, sometimes slightly winged. Leaflets coriaceous or subcoriaceous, obovate, suborbiculate or subrhomboid, often cuneate or even petiolulate at the base, glabrous or subglabrous above, tomentose or glabrous below, crenate, dentate or even pinnatifid, rarely entire, midrib and lateral veins prominent, especially on the lower side. Panicles lax, shorter or longer than the leaves. Drupe oblique, crowned by the slightly enlarged and hardened styles, glabrous or puberulous, smooth or verrucose.

Distribution: Caledon, Stellenbosch, Worcester, Malmesbury, and Clanwilliam districts, Namaqualand, Bushmanland, South-West Protectorate.

Diels (l.c. 613) includes *Rh. populifolia* (with which I unite *Rh. Steingroeveri* Engl.) and *Rh. dissecta* in his *Tomentosa* group, while *Rh. cuneifolia* is placed by him into his *Lucida* group between *Rh. lucida* L. and *Rh. scytophylla* E. et Z., for which I can see no adequate reason, as he himself has pointed out (l.c. 596) that no reliance can be placed on the indument in dealing with the taxonomy of *Rhus*.

A.—Petioles longer than the terminal leaflets............... 65. *Rh. dissecta* Thunb.

B.—Petioles shorter than the terminal leaflets.

(*a*) Greatest diam. of fruit 5–6 mm. Petioles $\frac{3}{4}$–1 cm. long. 64. *Rh. populifolia* E. Mey.

(*b*) Greatest diam. of fruit 6–8 mm. Petioles $\frac{1}{2}$–4 mm. long, 66. *Rh. cuneifolia* Thunb.

MUCRONATA group.

1. **Rh. mucronata** Thunb. (charact. emend.).

Remarks on *Rhus villosa* L.f., *Rh. mucronata* Thunb., *Rh. laevigata* L. (non Thunb.), and some other forms distinguished by various authors as separate species.

Rh. villosa L.f. [suppl. 183 (1781)] is supposed by many authors to occur from the south-west corner of Cape Colony to Abyssinia. Diels, in his valuable evolutionary studies on *Rhus* § *Gerontogeae* Engl. (in Engl. Bot. Jahrb. XXIV, 1898, 586), takes this species as a starting point from which the majority of African species are supposed to have been derived by adaptation. It is, therefore, of some importance to determine as accurately as possible what is meant by *Rh. villosa* L.f.

In the Linnean Herbarium, London (No. 26), there is a villous specimen named *Rh. villosum*. Unfortunately the name is in Smith's handwriting not in that of Linn. f. However, I am quite prepared to take this as the type of Linn. f., who first published it, though the name was given by Thunberg, from whom Linn. f. received many of his specimens.

In Jacquin's herbarium the same form is named *Rh. villosa.* In the herbarium of Thunberg, Upsala, there are two sheets marked *Rh. villosum.* On fol. *α* the leaflets are not villous, they are only slightly hairy. On fol. *β* the young branches, petioles, leaflets, etc., are villous, but it seems to me to be the species which I have called *Rh. MacOwani,* with which it shares the pyramidal many-flowered terminal inflorescence and the many-flowered lateral inflorescences. In Willdenow's herbarium, Berlin, there are specimens received from Thunberg which are a similar mixture as found in Thunberg's herbarium. In the Sloane collection at the British Museum there is a specimen marked "*Rhus incanum* Mill. dict. ed. 8 n. 8 (1760), Ray H. S. D 58, 14—Tab. 219, fig. 8". The last reference is to Plukenet Alm. 319 t. 219, fig. 8 (1691). It is evidently Plukenet's own specimen, but without flowers and fruit. However, it agrees sufficiently with the specimen in the Linnean collection that J. Britten was induced to dig out Miller's name, *Rh. incana,* and substitute it for *Rh. villosa.* (At the same time he changed *Rh. incana* Engl. into *Rh. Engleri*—see Journ. of Bot. XXXVIII, 1900, 316.) This, however, is only a side issue. The origin of Plukenet's specimen must be sought for in the neighbourhood of Capetown, and there we find the same form still.

It looks at first sight as if it was a pity that the very expressive name *Rh. villosa* has to be dropped, but even near Capetown this species is not always villous, and this introduces us to one of the difficulties encountered in dealing with this species. Already Sonder (l.c. 510) had distinguished a var. *glabrata,* which he identified with *Rh. pubescens* Thunb.* (Prodr. 52, Fl. Cap. ed. Schultes 265.) In this "variety" the leaves are glabrous or subglabrous. In March, 1925, two forms were sent by Dr. Marloth (11922 A, slopes of Table Mountain, shrub, 8 feet, and 11922 B, ib., compact low shrub, 3 feet) with the following remarks :- -"On a walk yesterday I found two bushes of *Rhus* close together. Though quite different in habit I found on closer examination no other difference but their hairiness. A would be *Rh. villosa* (by a slip Marloth put *tomentosa*), B would be *Rh. mucronata,* but even this shows a few hairs on the petioles. The fresh fruits of both are the same, globular slightly flattened on the poles. A still bears the galls of the insect which produces the "jumping eggs".† B has slightly but distinctly winged petioles which seem to go frequently with the glabrescent form, but even A is not so distinctly villous all over the leaflets as the type of *Rh. villosa* L.f.

When one goes further into the matter one finds it quite impossible to separate *Rh. mucronata* Thunb. from *Rh. incana,* although the former in Thunberg's‡ types appear to be quite glabrous, and only on very careful examination does one find a few scattered hairs on the petioles. A separation into two varieties as done by Sonder (l.c. 513) with the aid of Thunberg's originals is quite unjustified. There is still a further complication. Linnaeus has described a *Rh. laevigatum* which is quite different from the well-known species described under the same name by Thunberg. According to the author it has lanceolate leaflets, whereas in *Rh. incana* and *mucronata* they are more or less obovate-cuneate. The type in Herb. Linnaeus, London, has inflorescences like *Rh. incana* and *Rh. mucronata.* The flowers do not seem to be fully developed. Now this is the plant which Jacquin in Hort. Schoenbr. t. 345 figured as *Rh. elongata* and which Sonder (l.c. 513) made his *Rh. mucronata* var. *Jacquini,* under which he also placed the specimens of *Rh. mucronata* Thunb. fol. *β*. As a matter of fact, even in Linnaeus' specimens the leaflets are not strictly

* This species is not represented in Thunberg's Herb. and his description is insufficient.

† However, in January, 1928, he wrote : "As regards Nos. 11922 A and B. If one sees the two shrubs without examining them closely" (they agree in inflorescence, flower, and fruit) "one could always suspect two species and yet you put them both simply under var. *latifolia.* B has yellowish green or deep green foilage, almost shining ; A is a taller upright shrub with greyish foliage often covered with galls (moths galls), while I have not seen any galls on B, in spite of the fact that this is glabrous and apparently softer. Form A has the further peculiarity that in exposed places it sheds its leaves in winter and about a month elapses before the new leaves appear."

‡ There is a slip in Thunberg's description (Fl. Cap. ed. Schultes 265) *Rh. mucronata* : for "petioli" in the third line read "pedicelli".

lanceolate, although, again, Jacquin described the leaflets of *Rh. elongata* as lanceolate. Sonder is wrong in describing them as obovate. I have seen also Jacquin's types, and I quite agree that specifically they cannot be separated from *Rh. mucronata* Thunb. We can thus form an unbroken series from *Rh. incana* Mill. to *Rh. laevigata* Linn. (non Thunb.). Whether we are dealing here with a very variable species or whether there are several distinct species which hybridize freely cannot be decided without growing the various forms for years and subjecting them to cytological investigations. The species seems to be very sensitive to changes in ecological conditions. I have never seen a native specimen which is exactly like *Rh. laevigata* L., though one from Kirstenbosch (a damp locality) is very near it; but in the older European herbaria we often meet it under its right name. However, these specimens were all derived from European gardens.

Looking upon these diverse forms as members of one polymorphous species, the question arises what name to give it.

Rh. laevigata L.—This name has for over a hundred years been applied to quite a different species. The form which it represents has not been found wild in South Africa. It is a most inappropriate name as regards the villous form.

Rh. mucronata Thunb.—The occurrence of a mucro on the leaflets is very common in this "collective" species, though also found in numerous other species of *Rhus*. If the name was adopted it would, however, cover, what I may call, the major part of the species.

Rh. incana Mill. (*Rh. villosa* L.f.).—This is the oldest name. This form is only found in the neighbourhood of Capetown. I have examined a vast amount of material from Tropical Africa, and I am not satisfied that the large number of forms referred to this species can be legitimately associated with it directly, and if these two names are dropped we clear away at once the misunderstanding about its distribution which has crept into botanical literature. I may add, however, that the time is not ripe to deal again with the Tropical African species referred to *Rh. villosa*, because the material available, large as it is, is on the whole far too incomplete and frequently unaccompanied by detailed notes. As regards South African species *Rh. MacOwani* Schonl. (=*Rh. pubescens* E. and Z. non Thunb.) has frequently been mixed up with *Rh. villosa* L.f.

Assuming that this species easily responds to edaphic influences we may safely place with it such forms as have been described by Jacquin as *Rh. atomaria* in Hort. Schoenbr. t. 343.

In these forms which have somewhat thinner leaves than is generally found in the species, the petioles have a tendency to become longer and thinner. Mrs. Bolus sent a fair match of *Rh. atomaria* from Kirstenbosch, which has a high rainfall. On the other hand, specimens from sand-dunes and other xerophytic habitats have a tendency to form coriaceous leaves showing the coarse reticulation of the veins very plainly.

To my mind it will be best to adopt Thunberg's name, *Rh. mucronata* Thunb., and to deal with it under the following forms:—A. *typica*, B. *laevigata* (=*Rh. laevigata* L.), C. *atomaria* (= *Rh. atomaria* Jacq.), D. *latifolia*, E. *villosa* (=*Rh. incana* Mill., *Rh. villosa* L.f.).

Rh. mucronata Thunb. in Fl. Cap. ed. Schultes, 264 (species collectiva, charact. emend., non E. et Z. 1129). For synonyms see varieties below.

DESCRIPTION: A much branched, unarmed or somewhat spiny shrub, 2–8 feet high, villous, glabrous or glabrescent, with terete branchlets. Leaflets petiolate, petioles $\frac{1}{2}$–$\frac{2}{3}$ the length of the terminal leaflets, canaliculate above with a tendency in the glabrous forms to produce narrow wings. Leaflets generally subcoriaceous, obovate, broadly oblong or lanceolate, always with a more or less cuneate base and frequently acuminate at the apex, rarely acute, generally mucronulate, margin slightly revolute usually entire; midrib prominent on the lower surface, sometimes on both, lateral veins very slightly prominent, much broken and forming with the tertiary veins a coarse network, conspicuous in glabrous

or subglabrous forms. Panicles very lax, axillary shorter than the leaves, terminal generally longer. Flowers pedicellate, calyx lobes ovate obtuse, petals oblong, yellowish green. Drupe subglobose, very slightly depressed.

Length of petioles 8–15 mm. ; terminal leaflets generally 2·5–3·5 cm. ; lateral leaflets very variable.
Breadth of terminal leaflets generally 2–3 cm. ; lateral leaflets very variable.
Length of calyx lobes about ¾ mm. ; petals 1½–2 mm.
Diameter of drupe 5–5·5 mm.

DISTRIBUTION : South-west Cape Colony in the coast districts to East London, generally found not far from the sea.*

Before dealing with the varieties some remarks on a few specimens may be here inserted to show further that a clear distinction between them is impossible.

E. & Z. 741 (wrongly named *Rhus pendulina* Jacq.) in Herb. S.A. Mus. There are three branches, all from the dunes near Cape Recief, and apparently rightly associated with one another, but *one is quite glabrous.* The leaflets are either obtuse, mucronate or emarginate. Two have *villous inflorescences* (with glabrous flowers) and more or less villous petioles ; the leaflets are mostly obtuse (with or without a mucro), some are glabrous, others are pilose on the thick recurved margin and on the midrib of the underside.

E. & Z. 1101 (described as *Rhus Burmanni* DC. Prod. 2, 69) in scrub in the 2d. alt. on the Lion's Head, Nov., in S.A. Mus. Herb., is rather scrappy, very sparingly hairy, but seems to be indistinguishable from the glabrous form of E. & Z. 741.

Pappe 22 (identified in Herb. S.A. Mus. with E. & Z. 1101, evidently by Harvey) from the sides of Table Mt., Nov., consists of two specimens, one of which is similar to the glabrous form of 741, but has evidently thinner leaves in which the lateral veins are not so coarse as in 741. The other specimen has narrower leaves and both evidently represent a shade form. The flowers in all of them appear to be the same. The petioles in all of them are broadly furrowed above.

Pappe 22 in Herb. Alb. Mus. consists of two specimens. One, in young fruit, is quite glabrous. In the other there are a few flowers which do not seem to differ from those of typical *mucronata* : the branches seem to be young. They are densely villous as well as the petioles and even the leaflets are more or less villous, especially on the underside ; otherwise the leaves, though smaller and younger than in the glabrous branch, do not show any essential differences.

Forester Norris (5096), Bellville Flats, near Capetown, formerly white drift sand, Feb. alt. c. 90 feet :—

Leaflets glabrous, terminal about 3·5 cm. long, pale green above, still paler below midrib and veins reddish. Apex generally acuminate or mucronate or rarely slightly emarginate. Venation boldly reticulate. Petiole canaliculate above, sometimes faintly marginate. Inflorescence sparingly hairy. Drupe rather dry, pale yellow, turning into red, globular, about 5·5 mm. in diam.

Coppice shoots about a year old included in (5096) are quite different in appearance (though some fruiting branches are intermediate).

Leaflets much longer (terminal about 4·8 cm. long), softer and much thinner than in fruiting branches, frequently with one or two crenate teeth, petiole distinctly winged in upper part. Venation at first sight pinnate, but reticulations are seen faintly in transmitted light.

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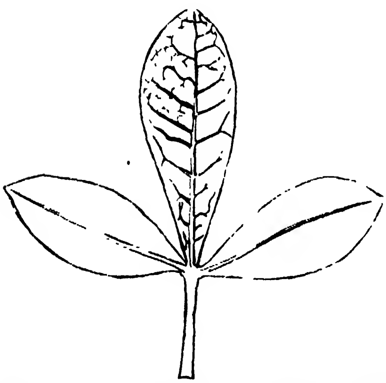
* Marloth (Das Kapland 1908, 133) states that *Rh. mucronata* is found in the dwarf macchia on the granite and limestone hills of the South-West as far as Saldanha Bay. Further, on p. 326, that this species is bare for about two months in winter, but sometimes the old leaves remain until the young ones have appeared, and that *Rh. villosa,* also an inhabitant of the macchia, loses its leaves in June, but replaces them already the next month.

" Deeply rooted, difficult to eradicate. Average height 10 feet. Locally known as Duinen Taaibosch. Straight stems are used by natives to make strong kerries, long ones are used for whipsticks ".

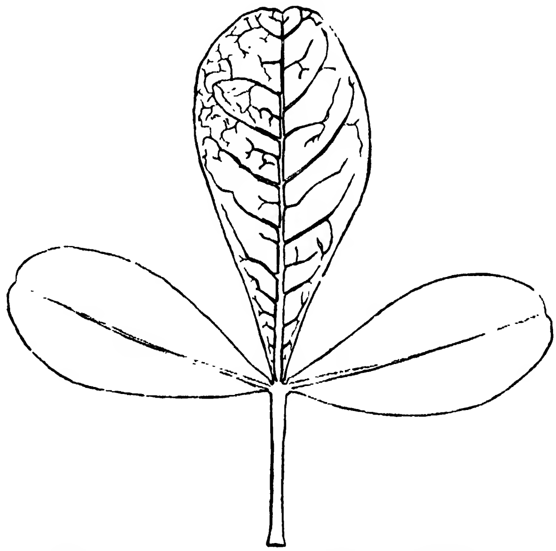
As stated above, I propose to divide the species into five varieties.

A. *typica*. *Rh. mucronata* Thunb. in Fl. Cap., ed Schultes, 264 ; *Rh. Burmanni** DC. in Prodr. II, 69 ; *Rh. Burmanni* et *pendulina* E. & Z. in Enum. No. 1101 and 1102 ; *Rh. Ecklomiana, tenuiflora* et *pilipes* Presl, Bem. (teste Harvey) ; *Rh. lucidum* Ait. hort. Kew, ed. 2, 166 (teste Engler).

Leaflets generally obovate, their breadth less than half their length subcoriaceous, quite glabrous or with very few minute hairs on the petioles or other parts. Apex obtuse or acuminate, rarely subacute.



Rh. mucronata Thunb., A. *typica, a genuina*. Muller (5116). Under side.



Rh. mucronata Thunb., A. *typica, a genuina*. MacOwan 1303. Upper side.

Rh. mucronatum fol. *a* and *β* in Herb. Thunberg ; sand dunes, Cape Flats, Marloth 11973, Lion's Head and Table Mountain, E. and Z. 1101, 1102 ; slopes of Devil's Peak, 1,400 feet, height c. 4 feet, very common ; Dec. (fl.), ? (4490) ; Cape Flats, on light sandy loam about 2 miles from False Bay, Van Roeper (5059, 5063) [These are a very good match of *Rh. mucronatum* Thunb. fol. *a* and very similar to *Rh. foetida* Herb. Jacquin] ; Caecilia plantation, Capetown, 4481 ; Uitvlugt, Cape Division, in sandy soil common, average height 6 feet, Muller (5115, 5116) [a good match of *Rh. mucronatum* Thunb. fol. *β*, which has slightly larger leaves than *a*, but there is no really tangible difference].

B. *laevigata*. *Rh. laevigata* L. (non Thunb.) in Sp. Pl. ed. 2 (1762) ; *Rh. elongata* Jacq. in Hort. Schoenbr. t. 345 ; *Rh. mucronata β Jacquini* Sond. l.c. 513 (p. pte.).

Leaflets subcoriaceous glabrous, oblong lanceolate, cuneate in lower half.

Herb. Linnaeus, London ; Herb. Willdenow, Berlin ; Herb. Jacquin, Vienna (*Rh. elongata* Jacq.). The nearest specimen collected in South Africa was contributed by Mrs. F. Bolus from Kirstenbosch (4475 in Herb. Alb. Mus.).

C. *atomaria*. *Rh. atomaria* Jacq. in Hort. Schoenbr. t. 343.

Leaves with somewhat more slender petioles than in A. Leaflets submembranous, resembling those of A in shape, subvillous on both surfaces.

Herb. Jacquin ; Kirstenbosch, Mrs. F. Bolus (4474) ; Table Mountain, Pappe 13 (= Z. 347 from Zwartland).

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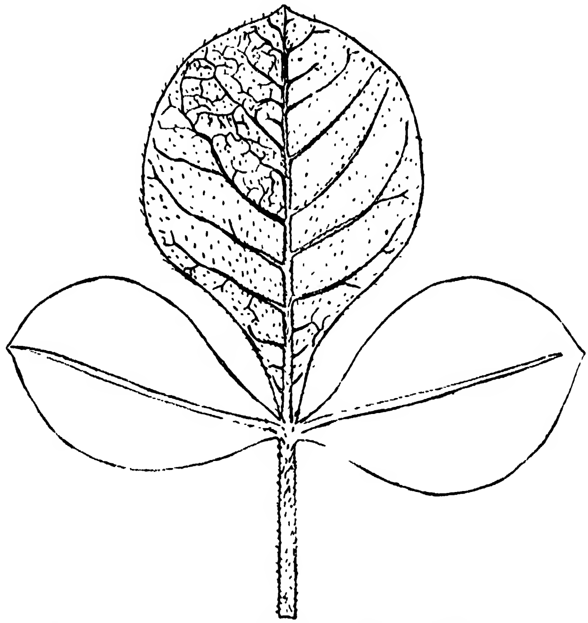
* All reference to Burm. Afr. t. fig. 2 is perhaps in future better omitted, since it is clear that, if it is meant to represent the same species as *Rh. mucronata* Thunb., it is a very bad figure, and it appears further from the letterpress that Burmann, like other earlier authors, lumped together different species.

D. *latifolia.* Breadth of leaflets half or more of length. Young branchlets, petioles, leaflets and inflorescences villous, older pilose or often glabrescent, generally blunt.



Rh. mucronata Thunb., D. *latifolia.* Pillans (5012). Upper side.

Slopes of Table Mountain, Marloth 11992 A and B; Kommetjes, Cape, Pillans (5012); above Camps Bay, Rogers 3032; Knysna Heads, Schonland 3527, 3532; Redhouse, Paterson 523*a*; Sandhills, Port Alfred West, Galpin 2941; East London, Rattray 178.

E. *villosa.* *Rh. villosa* L.f. suppl. 183 (non auct. plur.); Thunberg in Prodr. 52, Fl. Cap., ed. Schultes, 265; Sonder l.c. 510 (excl. var. *glabrata*); *Rh. incanum* Mill. Dict. ed. 8 n. 8, 1760; *Rh. tomentosum* Mill. (non Linn.) Pluk. Phyt. t. 219, fig. 7 (a form with coarsely crenate leaflets).

Leaflets, etc., retaining their heavy indument. Terminal leaflets subovate acuminate or obtuse, mucronate, narrowed from about the middle to a cuneate base. Lateral leaflets generally oblong, obtuse or subacute, mucronate with a cuneate base.

Herb. Linnaeus, London; Herb. Thunberg, Upsala and various other old collections [e.g. Plukenet's in Sloane collection, British Museum, types of *Rh. incanum* Mill. and *Rh. tomentosum* Mill. (non L.)]; Signal Hill, Capetown, 1,000 feet, Marloth 9470*b*; Uitvlugt, Cape, sandy soil, very rare, grown flat about 2 feet, Muller (5117); Klipfontein, Zwartland E. & Z. 1099 (in S.A. Mus.); side of Lion's Head and Table Mountain E. et Z. 1098.

The following specimens belonging to E. *villosa* were noted by me in the Berlin Herbarium, Dahlem:—

1. ex Herb. Alex Braun, *Rh. aequalis* Pers. " non DC. fraglich mit *Rh. villosum* vereinigt " h.B. 58.
2. Hort. Bot. Benth. *Rh. pubescens* β *caledonica* (subglabrous forms ex hort. Bot. Berol. 1843 bear the same name).
3. Herb. Gundelsheimer (beginning of eighteenth century) " Rh. Africana trifolia tomentosa ".
4. " Rh. trifolium Africanum " (probably also Gundelsheimer coll.).
5. *Hort. Monac.* ? a narrow leaved form. (One old leaf is subglabrous and shows the typical venation of " mucronata ".)

Various other cultivated specimens, some of which are called *Rh. atomaria* Jacq.

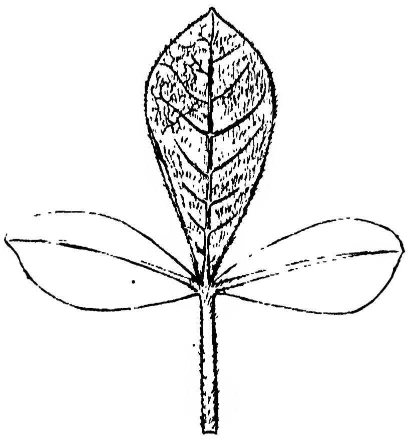
Drège 5572 (*Rh. villosa* L., *Rh. atomaria* Jacq.), showing stages leading to typical *Rh. mucronata*; Bergius 24, Oct. 15, mostly with smaller leaves than usual.

Hybrids : It has already been stated that the question whether the forms placed here under *Rh. mucronata* represent a series of hybrids must for the present be left undecided. Apparent hybrids with other species are very rare.

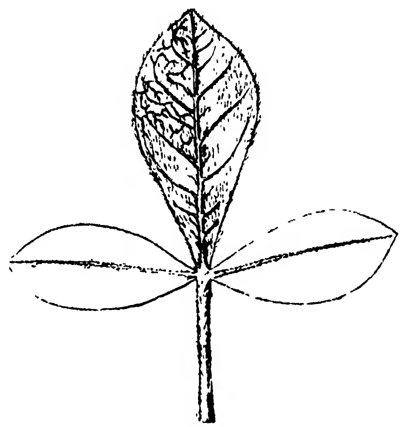
Rh. mucronata X *MacOwani* ?, Pappe (?), Caledon, Nov. (in Herb. S.A. Mus.). Flowers as in *Rh. mucronata*. Inflorescence as in *Rh. MacOwani*. Young branches, inflorescences, upper side of leaflets and veins on lower side pilose.

Rh. mucronata X *puberula* ?, Z. 2236, Cape Recief (in Herb. Kew.).

See also *Rh. Legati* Schonl.



Rh. mucronata Thunb., E. *villosa*. Marloth 9470*b*. Upper side.



Rh. mucronata Thunb., E. *villosa*. Marloth 9470*b*. Under side.

2. **Rhus Ernesti** Schonl. nov. sp.

Rh. incana var. *Galpinii* Burtt-Davy Ms.

Description : Frutex vix 1 m. altus ramulis teretibus villosissimis. Folia petiolata, petiolis villosissimis subteretibus supra leviter canaliculatis ; foliola oblonga vel subovata apice obtusa vel subacuta saepius breviter mucronata, basi cuneata ; margine subplana integra ; utrinque sericeo-villosissima costa venisque pilis patentibus tectis ; costa venisque utrinque leviter prominulis. Paniculae laterales foliis breviores, terminales longiores, parce ramosa, floribus sessilibus (♀ ignotis). Calycis lobi inaequales lanceolati extus tomentosi. Petala oblonga glabra. Drupa ignota.

Length of petioles about 2 cm. ; terminal leaflets up to 4·5 cm. ; lateral leaflets one-half to two-thirds of terminal leaflets.

Breadth of terminal leaflets up to 2·5 cm. ; lateral leaflets one-half to two-thirds of terminal leaflets.

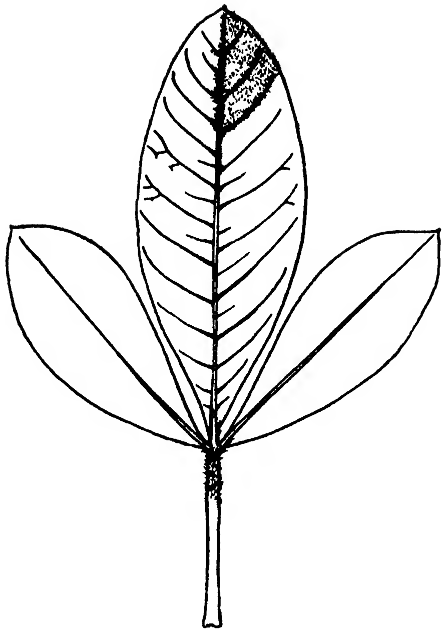
Floral bracts slightly exceeding 1 mm.

Length of calyx lobes 1–1¼ mm. ; petals 1½–1¾ mm.

Distribution : Only known from the neighbourhood of Barberton.

Saddleback Mountain, near Barberton, 4,000 feet, Galpin 1016 ; Barberton, Thorncroft 27777 (in Herb. Transv. Mus.).

This has at first sight the look of typical *Rh. mucronata*, E. *villosa*, but the inflorescences and floral structure are different. The patent hairs on the midrib and lateral veins (more lightly coloured than the other hairs on the leaves) are also not found in *Rh. mucronata*. It is a pity there are no fruits known.



Rh. Ernesti Schonl. Galpin 2777. Under side.

Perhaps some specimens collected by Rademacher (Trans. Mus. 7270) at Carolina, Transvaal, must be placed here. The shoots collected seem to be dwarfed for some reason and both flowers and leaves are smaller than in typical *Rh. Ernesti*. The terminal leaflets do not exceed 1 cm. in length; the petioles are about 5 mm. long.

3. **Rh. MacOwani** Schonl. nom. nov.

Rh. pubescens E. et Z. (non Thunb. ?) in Enum. 1100.

Rh. pyroides Sond. p. pte. (non Burch.) in Fl. Cap. II, 511, Engler, l.c. 430, and Diels, l.c. 582, 594, 628; *Rh. villosa* auct. plur. (non L.f.).

I take as types the specimens distributed by Ecklon and Zeyher under No. 1100. Whether they were right in naming them *Rh. pubescens* Thunb. must remain undecided as there is no original of Thunberg's species preserved, and the description in his Fl. Cap., ed. Schultes, 264, is not detailed enough. It is quite distinct from *Rh. pyroides* Burch., though I must admit that isolated branches from these two species are sometimes difficult to distinguish. Generally speaking, *Rh. MacOwani* is not so strikingly divaricately branched than *Rh. pyroides*, its petioles are relatively shorter and thicker, its panicles are larger and denser, its flowers are slightly smaller, its pubescence is generally not so appressed and silky, and is more apt to be more or less shed on older leaves. It has much smaller flowers, smaller and compressed drupes, and different inflorescence as compared with *Rh. mucronata*, E. *villosa*, which it sometimes resembles in its leaves.

The new name was given in memory of the late Dr. P. MacOwan.

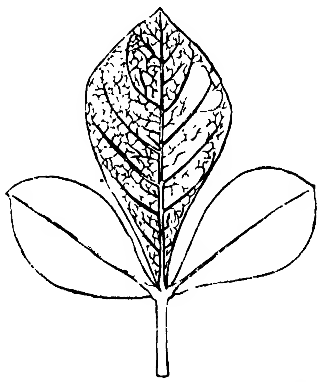
Description: A shrub or small tree, sometimes reaching a height of over 30 feet; branchlets terete, softly villous. Leaves petiolate, petioles subterete slightly furrowed above, at first villous, later often glabrescent. Leaflets at first pubescent or villous, later often glabrescent, ovate or obovate-cuneate, obtuse, acute or somewhat acuminate,

sometimes minutely mucronulate; margin not or very slightly revolute, entire or occasionally sparingly crenate or dentate; midrib and the arcuate, slightly branched, lateral veins slightly prominent on the upper surface, more so on the lower, tertiary veins reticulate (especially distinct on the upper surface when the hairs have more or less disappeared). Panicles pubescent, much branched and multiflowered, axillary about as long or longer than the leaves, terminal much longer than the leaves; bracts small, lanceolate, acute, pubescent. Flowers shortly pedicellate; calyx lobes ovate, pubescent, nearly half the length of the oblong petals. Drupe somewhat juicy, subglobose, slightly compressed, cream-coloured or with a tinge of red.

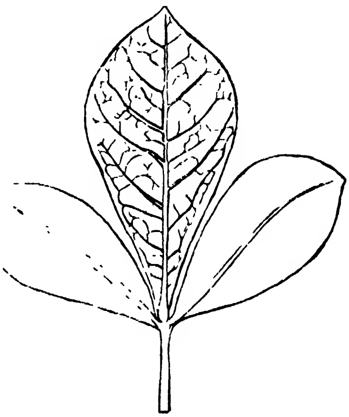
Length of petioles about 1·5 cm.; terminal leaflets 2·5–3·5 cm. (rarely up to 5 cm.); lateral leaflets about two-thirds of terminal leaflets.

Breadth of terminal leaflets 1·5–2 cm. (rarely up to 3 cm.); lateral leaflets about two-thirds of terminal leaflets.

Length of calyx lobes ½ mm.; petals 1–1¼ mm. Greatest diameter of drupe 3 mm.



Rh. MacOwani Schonl. E. and Z. 1002 (1100). Upper side.



Rh. MacOwani Schonl. E. and Z. 1100. Under side.

DISTRIBUTION: In the coast districts from near Bains Kloof to Swaziland and the Transvaal, perhaps also in Tropical Africa (often placed under *Rh. villosa*, but the specimens placed under this species in various large European herbaria are a curious mixture of species and frequently incomplete). It is found in open scrub and in stream-bank bush from near sea-level to an altitude of at least 3,000 feet. Sometimes, especially along streams, it develops into a much branched tree which, e.g. at Keiskama Hoek and near Riebeek East, reach a height of over 30 feet. It flowers from December to April.

Occasionally leaves with four or five leaflets are found. Usually coppice shoots do not exhibit any unusual features, but all found on one stump of a tree on the farm Aylesby, near Riebeek East, had leaves with five leaflets. The petioles had a broad shallow channel above and were slightly winged, the branchlets and petioles were pubescent, the leaflets almost glabrous.

On the banks of the Zwartkops River and in the woods of Krakakamma, E. and Z. 1100, E. 1002; Burchell 949, 3001, 3044, 4888 in Herb. Kew; Drège 6800, also specimens by Drège distributed as *Rh. villosa* var. *subdentata b* and *Rh. villosa a* in Herb. Kew; Dal Josaphat, 600 feet, Tyson 898; Swellendam, in woods, Pappe 15; Zuurbraak, c. 800 feet, Schlechter 2127; mountains near Prince Alfred, 1,700 feet, Schlechter 9979 (very close to the form which Engler described from the Transvaal as *Rh. Rehmanniana*); Vet Rivier, Riversdale Division, 400 feet, Muir 3471 (terminal leaflet up to 7·5 cm. long); neighbourhood of Knysna from near sea-level to about 700 feet, in some of these the villosity is retained [as e.g. also in Schlechter 2127 and Pappe 15], on the under side of the adult leaflet, Duthie 13, 571*a*, Cloete 5128, Williamson 36, Schonland 4150, 3496, 3524; edge of indigenous forest, Blaauwkrantz, 5013, 5026; Haarlem, near railway bridge, 2,700 feet, Fourcade 3161; Assegai Bush, Humansdorp division, Fourcade 1145, Zahn 5051, Britten 1343, Schonland 3632; Kleinfontein, near Hankey, J. Sim 182; Van Stadens, and Kamaehs, near Uitenhage, Paterson 523; Port Elizabeth, Kemsley 260; Zuurberg, Holland 119; neighbourhood of

Grahamstown up to about 2,000 feet, Britten 1523, Dyer 45, 209 (many leaflets crenate or crenate-dentate near apex), Schonland 4414 (many leaflets as in Dyer 209, some leaves have four, others five leaflets), MacOwan 505/1218 (leaflets more elongated than usual and relatively narrower); Blaauwkrantz drift, Britten 1406 (leaves very much as in Muir 3471), 2736; Lushington valley, near road to Bathurst, Schonland 5168; Debe Nek, Rogers 4461; Katberg, Staples 5018; Keiskama Hoek, near the village; Komgha, 2,000 feet, Flanagan 798; Umzimkulu River, near Clydesdale, 15008, Tyson 2870; Umtata, 3,500 feet, Schlechter 6359; Ntsubane, Lusikisiki, Fraser 73/20/A (5099), 73/40/B (5164), 5098, Infengo Forest, Lusikisiki district, Fegen (5162), Pondoland, Bachmann 819; Friedenau, Natal, Rudatis 112, 1624; Hlatikulu, Swaziland, Stewart 2555 and 9538 (of the Herb. Transvaal Mus.).

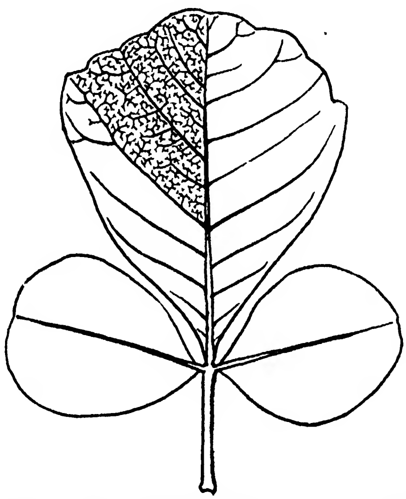
In Herb. Alb. Mus. there is a specimen from Oudtshoorn (Britten 34), unfortunately rather poor, which seems to belong here. It is glabrescent. The flowers appear to be *perfectly hermaphrodite*, a rather unusual occurrence.

Some Transvaal specimens, which I have seen, may belong here, but fuller material is required to make quite sure.

forma *Rehmanniana.*

Rh. Rehmanniana Engl. l.c. 422, Diels l. 578, 613.

Leaflets obovate or obovate truncate, the terminal one more or less narrowed at the base, entire in the lower part, crenate or crenate-dentate in the upper.



Rh. MacOwani Schonl., *forma Rehmanniana.* Rehmann 5560. Upper side.

Specimens which can be placed under this form are especially found in Natal and the Transvaal, but can be fairly closely matched with others found right to near the western limit of the species, e.g. Schlechter 1977. The amount of hairiness on the adult leaves varies as in typical forms.

Houtbosch, Transvaal, 5560, 5561; Barberton, Thorncroft 4532; Berlin forest reserve, on edge of great escarpment, c. 4,500 feet, Keet (5166); Middelkop plantation, near Tzaneen, common, usually in moist localities, Evans (5129); Colenso, Schlechter 6892; Friedenau, Natal, c. 500 feet, Rudatis 331 in Herb. Kew.

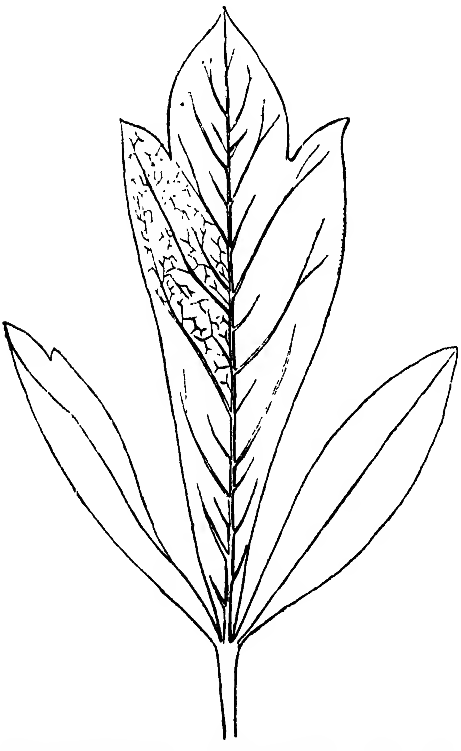
4. **Rh. Fraseri** Schonl. nom. nov.

Rh. tridentata Sond. in Fl. Cap. I, 511; Engler, l.c. 425; Diels, l.c. 580, 623 (non *Rh. tridentatum* Thunb. in Fl. Cap. ed. Schultes 222); *Rh. hirta* Harv. Ms. in Herb. Kew.

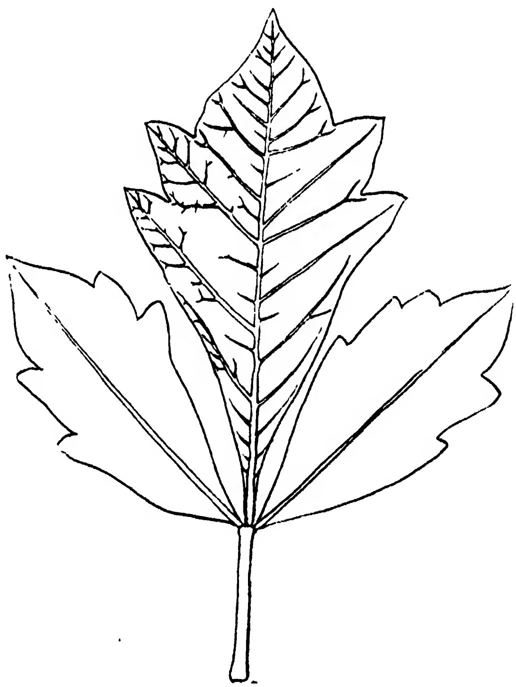
Named after Forester G. Fraser, Ntsubane, Lusikisiki, to whom I owe a great deal of material of *Rhus*, and whose No. 73/23/A (5143) agrees well with Gueinzius 390 from Natal in Herb. Kew, the type of *Rh. tridentata* Sond.

DESCRIPTION: Shrub with elongated, terete, tomentose, densely leafy branchlets. Leaves petiolate, petioles $\frac{1}{4}$–$\frac{1}{3}$ the length of the terminal leaflets (rarely somewhat longer), tomentose or pilose, deeply furrowed above. Leaflets pubescent, dark green and often glabrescent above, greyish green, pubescent below, more or less oblong, the terminal one becoming cuneate towards the base from above the middle or lower; margin slightly revolute, entire or with a few mucronulate gross teeth near the apex (often the terminal ones toothed, the lateral ones entire or all entire); midrib and lateral veins slightly prominent above, more so on the under side, tertiary veins reticulate (but indistinct even on glabrescent surfaces). Panicles tomentose from the axils of the upper leaves and (about equalling them in length) and terminal (longer than the leaves), much branched and multiflowered, bracts small, subulate; flowers pedicelled. Calyx segments pilose, especially along midrib, ovate $\frac{1}{3}$–$\frac{1}{2}$ of the oblong petals. Drupe subglobose, brownish, shining.

Length of petioles 1–2 cm.; terminal leaflets about 7 cm.; lateral leaflets 4–5 cm.
Breadth of terminal leaflets 2–3 cm.; lateral leaflets 1·5–2 cm.
Length of pedicels 1–1·5 mm.; calyx segments $\frac{1}{2}$–$\frac{3}{4}$ mm.; petals $1\frac{1}{4}$–$1\frac{1}{2}$ mm.
Diameter of drupe c. 4·5 mm., height 5·5–6 mm.



Rh. Fraseri Schonl. Gueinzius 390. Upper side.



Rh. Fraseri Schonl. Fraser (5149). Under side (woolly hairs hiding tertiary veins).

DISTRIBUTION: Natal, Pondoland, and on the Amatola mountains. Engler has distinguished a variety *integrifolia*, which, however, I must drop as the occurence of teeth is never constant.

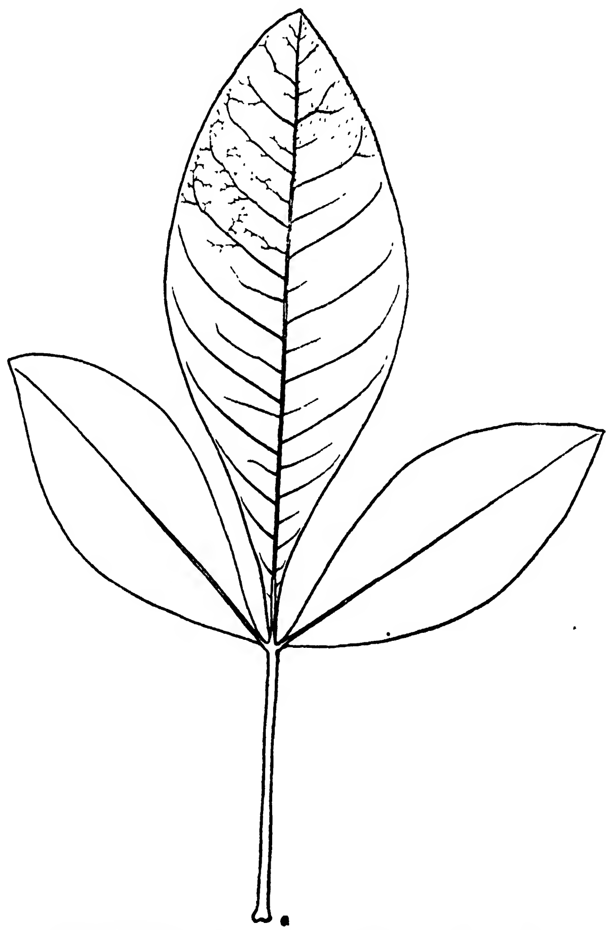
Natal, Gueinzius 390; Weza forest reserve, Harding, c. 4,000 feet, A.D.F.O. (5054, 5043); Pinetown and Inanda, Wood 852; Verulam, Wood 3908; Dumisa, Alexandra county, 600 m., Rudatis 801; Ntsubane, near Lusikisiki, Fraser 73/22/a (5143); Hogsback, grassy valleys, Rattray 291. Fraser (5149), from Ntsubane, is without flowers and has much broader leaves than the type. I think it is a coppice shoot.

5. **Rh. intermedia** Schonl. n. sp.

Allied to *Rh. Fraseri* Schonl. and extreme forms resembling *Rh. Legati* Schonl. (*Rh. laevigata* Thunb. non Linn.), but the pubescent branchlets, petioles, etc., distinguish it easily.

Description : Frutex 3–5 m. altus ramulis gracilibus teretibus griseo-vel fusco-villosis. Folia petiolata petiolis gracilibus primum villosis deinde sparse pilosis subteretibus interdum supra leviter canaliculatis. Foliola membranacea oblonga apice acuta vel acuminata mucronulata vel plicato-mucronulata basi saepius cuneata (terminalia saepius basi valde angustata vel petiolulata) ; margine leviter revoluta vel plana integra vel rarius apicem versus paucidentata ; juvenilia utrinque villosa, adulta utrinque pilosa vel glabrescentia ; costis et venis lateralibus utrinque leviter prominulis, nervis reticulatis non prominulis. Paniculae villosae multiramosae axillares foliolis subaequilongae, terminales foliis longiores bracteis subulatis floribus parvis pedicellatis. Calyxis lobi ovati acuti. Petala oblonga. Drupa subglobosa compressa.

Length of petioles 2·3–4 cm. ; terminal leaflets 7–10 cm. ; lateral leaflets about 3 cm.
Breadth of terminal leaflets 5–6·5 cm. ; lateral leaflets 2–2·3 c.m.
Length of calyx lobes barely ½ mm. ; petals barely 1¼ mm.
Greatest diameter of fruit about 3 mm. (similar to drupe of *Rh. MacOwani* Schonl.).



Rh. intermedia Schonl. Tustin (5122). Upper side.

Distribution : On the edge of forests from Natal to the northern Transvaal.

Those in search of natural hybrids might look upon this " species " as a hybrid between *Rh. MacOwani* and *Rh. Legati*. Against this view is the fact that it does not occur west of Natal, where these two species are commonly found close together.

Ngomi forest reserve, P.O. Hlobane, Natal, Tusten (5122); Diepkloof, Zoutpansberg, Burtt-Davy 5174; Halic forest station, Zoutpansberg, 4,200 feet, (5024); Woodbush plantation, P.O. Haenertsburg, common, c. 4,000 feet, Coilett (5077); De Hoek, Tzaneen, Pretorius (5086); ? Graskop, Evans (5109).

6. **Rh. pyroides** Burch. Trav. I, 340 (1822), Cat. Geogr. 1796.

Rh. sericophylla Schlecht. in Engler Pflanzenwelt Afrikas III, 2.

Rh. flexuosa Diels in Engl. Bot. Jahrb. XL, 86 (1907).

(For further synonyms see below.)

This species was found by Burchell on the Asbestos mountains. The type is preserved at Kew. He described it as follows: " Frutex 6–10 pedalis. Ramuli saepe spinescentes. Folia ovato-lanceolata integerrima glabra. Racemi axillares folio breviores; terminales longiores ". By comparison with De Candolle's description in Prodr. II (1825) 70, it will be seen that DC. seems to have described a different plant (foliolis obovatis-oblongis mucronatis, etc.), and the error has been perpetuated by subsequent authors, At all events both Sonder (l.c. 1, 511) and Engler (l.c. 430) took it to be the species which Ecklon and Zeyher distributed as *Rh. pubescens* Thunb. and which I have named *Rh. MacOwani*.

Description: The following notes were taken from Burchell No. 1796 at Kew:—A shrub (or scrambler) with very stout thorns, which are straight or curved and are 3–3·5 cm. long. Bark of older branches grey with numerous raised lenticels. Branchlets slender, 12–15 cm. long, terete, slightly puberulous. Leaves petiolate, petioles slender, 1·7–3 cm. in length, not exceeding half the length of the terminal leaflet, slightly furrowed above, puberulous. Leaflets submembranous, oblong-cuneate, usually acute, often shortly mucronulate; margin entire or with one or two teeth, upper surface subglabrous, lower slightly puberulous, subpilose on midrib and veins; venation reticulate, sometimes very distinct on both sides, but often tertiary veins hardly visible on upper side and indistinct on lower. Terminal leaflets 4–7 cm. long, 1·7–2·5 cm. broad. Lateral leaflets variable in size, often about $\frac{2}{3}$ the length of the terminal, often the two belonging to one leaf slightly different in size and shape. Panicles lax, puberulous, shorter than the leaves, lateral and terminal on the young branches. Flowers on short pedicels. Drupe subglobose, evidently slightly compressed, about 3 mm. in diameter.

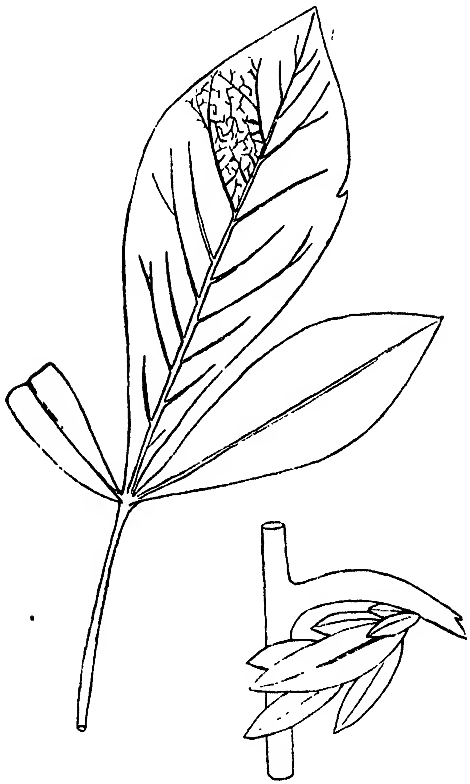
The following agree closely with the type (except that sometimes the pubescence is more prominent): Karreefontein, Griqualand West, March 21, Wilman; Papkuil, Wilman, February 1921; Newlands, Griqualand West, December 20, Wilman.

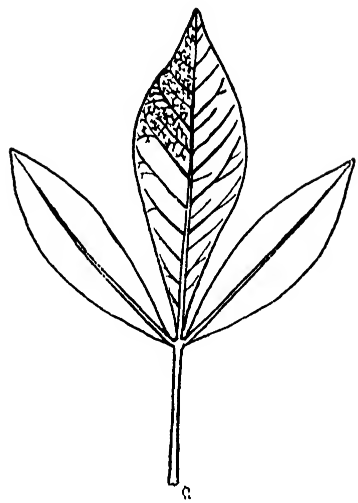
From these specimens the following description was drawn up:—

Frutex squarrosus saepius spinosus ramulis patentibus pubescentibus; foliis petiolatis, petiolis gracilibus teretibus pubescentibus foliolis brevioribus, foliolis membranaceis glaucis utrinque adpresse pubescentibus vel adultis interdum subglabris ovato-lanceolatis basi cuneatis vel rarius petiolulatis apice acutis vel subacutis rarius emarginatis saepius submucronatis margine integris rarius irregulariter crenatis subrevolutis, lateralibus et terminalibus subaequalibus vel lateralibus brevioribus costa atque nervis utrinque prominentibus venis reticulatis utrinque prominentibus; paniculis pubescentibus laxis, lateralibus et terminalibus, bracteis anguste lanceolatis acutis; floribus pedicellatis, calycis segmentis triangularibus, petalis pallide luteis late oblongis subduplo longioribus, disco (in floribus masculis) 5– (vel sub 10–) crenato; drupa subglobosa compressa.

Petioles 1·2–2 cm. long (rarely shorter or longer, but rarely half the length of the terminal leaflet).
Leaflets 3 cm. long (average size; the relative length of terminal and lateral ones varies greatly).
Panicle $2\frac{1}{2}$–4 cm. long (rarely longer). Floral bracts about 1 mm. long. Pedicels 3–4 mm. long.
Calyx segments $\frac{1}{2}$–$\frac{3}{4}$ mm. long. Petals $1\frac{1}{4}$–$1\frac{1}{2}$ mm. long. Drupe $3\frac{1}{2}$–4 mm. in diameter.

All these may be united as var. A. *typica*, and the following specimens may also be referred to this form :—





Rh. pyroides Burch. A. *typica.* Wilman 1256. Upper side.

Rh. pyroides Burch., A. *typica.* Burchell 1796. Upper side. A thorny branch of the same.

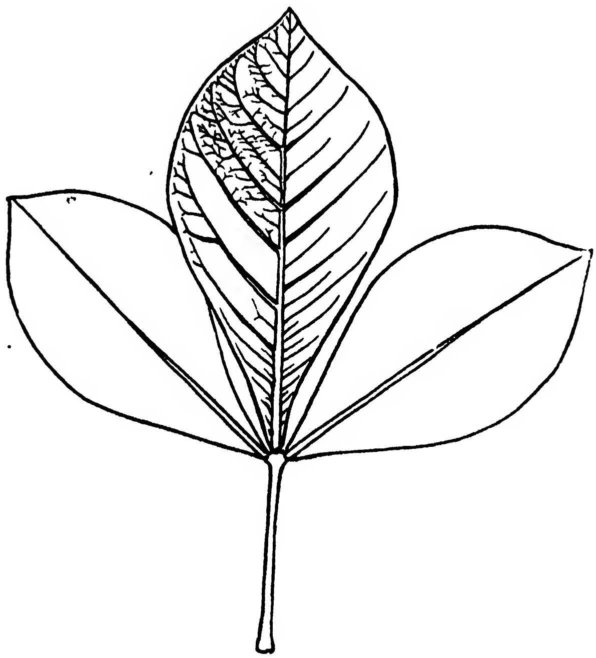
Bloemfontein, Potts 3221 (fl. Nov.), Potts 1672 (young fr., Dec.), Potts 2052 (fl. Nov.), Potts 1337 (spreading bush 20 feet high by 20 feet wide), Potts 1220 (fl. Nov., spreading bush, sometimes a tree); Krom River, Karroo, Potts 1336; Trompsburg, Potts 3302, 3305, 3306 (fr. Jan.); Vereeniging, Jan., Burtt-Davy 15139; Kaffraria ? Cooper 538 in Herb. Kew; Cradock district, Cooper 510 in Herb. Kew.

There is a form very common, especially in the Transvaal, with larger, sometimes flexuous inflorescences, which, moreover, when young, have the flowers arranged in glomerules. This may be called var. C. *transvaalensis* (usually named *Rh. villosa* L.f. in numerous herbaria or *Rh. villosa* L.f. var. *gracilis* Engl.); *Rh. flexuosa* Diels and *Rh. sericophylla* Schlecht. may be referred to this form.

Harrismith, Sankey 246; Johannesburg, Gilfillan 6201 and 6202 in Herb. Galpin; Magaliesberg, Burke in Herb. Kew (erroneously marked "Fish River"), Z. 342; Aapies River, 4,800 feet, Schlechter 3609; Pretoria, Burtt-Davy, Rehmann 4740, 4742, Wilms 242, Leendertz 34 and 508, Reck 1089, Thomson 6663; Howlett 1; Naboomspruit, Galpin M 63; Warmbaths, Burtt-Davy 5093; Lydenburg district, Wilms 238; Rustenburg, Nation 197; Crocodile River, Schlechter 3982; Marico district and Schweizer Reneke, Holub in Herb. Kew; Bowker's Park, 10 miles west of Queenstown, 3,500 feet, Hilner 324; Lesseyton drift, Queenstown, Galpin 2574; Berry Reservoir, Queenstown, Hilner 344; Ugie, Surat, 4,300–4,500 feet, Britten 4691; Katberg, Staples 5018; Ntsubane, Lusikisiki; Mont aux Sources, Tugela Valley, 5,000 feet, Bayer and MacClean 33.

Pott 4934, from Mavieristad, was named by Burtt-Davy *Rh. incana* var. *sericea*. It belongs to *Rh. pyroides*, but requires further examination.

This form is evidently widely spread along the Drakensbergen into Swaziland, but I am afraid of quoting further numbers without re-examination. When, as frequently happens, the terminal inflorescence is large and densely multiflowered it cannot be easily distinguished from *Rh. MacOwani* except that this is more or less incano-pubescent, whereas the pubescence in *Rh. pyroides* is appressed sericeous and in the later the petioles are more slender than in *Rh. MacOwani*.



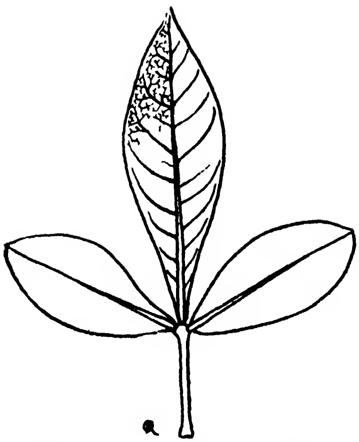
Rh. pyroides Burch., B. *transvaalensis*. Leendertz 34. Under side.

Forms which must be referred to *Rh. pyroides* Burch. are also common in Tropical Africa and are usually called *Rh. villosa* L.f.

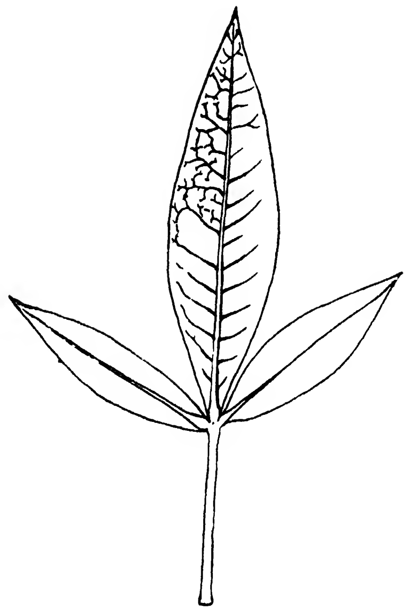
C. *puberula*—*Rh. puberula* E. et Z. in enum. 1104, Sonder l.c. 511, Engler l.c. 427, Diels l.c. 587 (excluding var. *fastigiata* Sond. l.c. 512); *Rh. sericea* E. et Z. in enum. 1105; *Rh. Meyeriana* Presl Bem.

In the Berlin Herbarium specimens belonging to the true *Rh. pyroides* Burch. are placed by Engler under *Rh. puberula* E. et Z. without having been recognized as belonging to Burchell's species. As I agree that these two species belong together the name *Rh. puberula* must be dropped since Burchell's name is the older. The chief difference is mainly in size of petiole and leaflets; the former is generally 5–8 mm. long, the terminal leaflets 1·5–2 cm. long, 8–10 mm. broad, the lateral about two-thirds the size of the terminal The frequently oblique plicate apiculus of the leaflets seems to be a fairly characteristic feature of this form.

DISTRIBUTION: Eastern Cape Province, Natal, Orange Free State, Transvaal. In open bush, locally common, rarely exceeding 7 feet in height, flowering generally from January to March.



Rh. pyroides Burch., C. *puberula*. MacOwan 862. Under side.



Rh. pyroides Burch., C. *puberula*. Zoutpansberg (5005). Under side.

Burchell 4744, 4874 ; Drège 6808A (*Rh. Meyeriana* Presl) ; Albany, Zeyher 888 (leaflets broader than usual) ; Geelhoutboom River, Humansdorp division, Fourcade 2123 ; Assegaibush (Albany), E. et Z. 1105 (type of *Rh. sericea* E. et Z.) ; south side of mountain drive, Grahamstown, R. Schonland ; ib., MacOwan 766 ; Katberg, MacOwan 862, Staples (5018), (5022) ; Fort Fordyce, Hoesslin (5123) ; Hogsback ? (5022) ; Wolfridge, near Keiskamma Hoek, Hunter (5086*b*) ; mountain sides near Silo, E. et Z. 1104 (type of *Rh. puberula* E. et Z.) ; near Queenstown, Hilner 324, 344, Galpin 2574 ; Komgha, Flanagan 800, Schlechter 6164 ; between Umtata and the Umzimvubu, Drège (5575 distributed as *Rh. angustifolia* L. *a*), Drège 5574, 5576 ; Pondoland, Bachmaan 821, 823, 825 ; Murchison, Wood 3126 ; Natal, Gerrard 1879 ; Government plantation, Harrismith (5139) ; Dunelm Farm, Fouriesburg, Potts 3310, 3311 ; Barberton, Thorncroft in Herb. Trans. Mus. 4495 ; Klaserie siding, Lydenburg, Keet 5160.

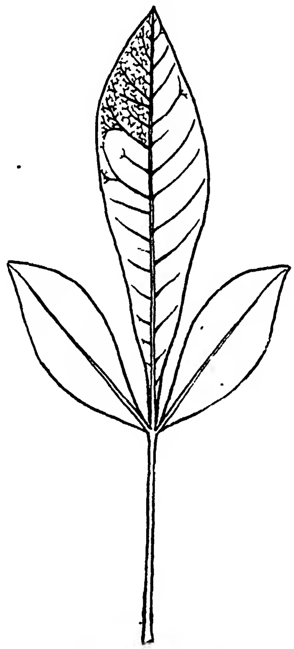
7. **Rh. Baurii** Schonl. n. sp. (*Rh. pyroides* Burch. var. *glabrata* Sond. in Fl. Cap. II, 511).

Closely allied to *Rh. pyroides* Burch. Sonder characterizes his variety as follows : " Branches and leaves subglabrous or glabrous, panicles pubescent ". As he mixed up *Rh. pyroides* with the species called *Rh. pubescens* Thunb. by Ecklon and Zeyher, quite distinct plants may be placed under this variety. In addition to the characters mentioned the plants placed by me under *Rh. Baurii* have the following distinguishing characters :— Leaflets thinner than in *Rh. pyroides*. Petioles very slender, more than half the length of the terminal leaflet, sometimes almost equalling it. The terminal leaflet is very frequently subpetiolate, as it is usually very much narrowed at the base, but this also occurs in *Rh. pyroides*, though more rarely.

Description : Frutex inermis laxe ramosus ramulis gracilibus subteretibus subglabris vel pubescentibus. Folia petiolata, petiolis gracilibus, supra leviter canaliculatis. Foliola membranacea oblonga acuta, terminalia saepius valde attenuata, juvenilia adpresso-pubescentia deinde subglabra (costa venisque exceptis), ad margines integra vel paucidentata, reticulata costa utrinque prominenti, nervis lateralibus arcuatis utrinque leviter prominentibus, venis supra leviter prominentibus subtus immersis. Paniculae ex axillis foliorum

superiorum laterales foliis subaequales et terminales quam folia longiores, adpresso-pubescentes laxe ramosae, bracteis parvis, floribus pedicellatis. Calyx extus adpresso-pubescens lobis triangularibus subacutis. Petala oblonga. Drupa (Galpin 2340) subglobosa leviter compressa.

Length of petiole usually about two-thirds the length of the terminal leaflet.
Length of terminal leaflet usually about 6 cm., sometimes less.
Breadth of terminal leaflet usually about 2 cm.
Length of lateral leaflets two-thirds to five-sixths of the terminal leaflet; floral bracts about ¼ mm.; pedicels up to 2 mm.; calyx lobes ½–¾ mm.; petals 1¼–1¾ mm.
Greatest diameter of drupe 3 mm.



Rh. Baurii Schonl. Baur 856. Under side.

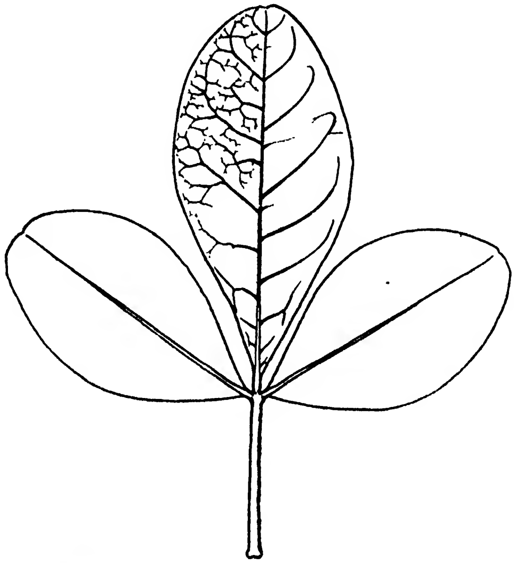
Distribution: Midlands of Cape Province at an altitude of 2,500–4,000 feet.

Graaff-Reinet, by margin of watercourses, 2,500 feet, Oct., Bolus 134; Murraysburg, along water-courses and in open veld, 4,000 feet, Sept., Tyson 61; Sheldon, Nov., Rogers 151; Shiloh, 3,500 feet, Dec., Baur 856; near Queenstown, Jan., Hilner 336 (fairly commom at the Berry Reservoir), Galpin 2200 (north-western mountain, waterside), Galpin 2201 (north-western mountain, rocky ridges; leaves much smaller than usual), Galpin 2340 (kopje Du Plessis farm, Klaas Smits R.; some leaves are 3 cm. wide and more or less crenato-dentate).

8. **Rhus nebulosa** Schonl. n. sp.

Description: Frutex laxe ramosus interdum spinosus ramulis subteretibus glabris vel parce pilosis; foliis petiolatis, petiolis quam foliola brevioribus pilosis, supra apicem versus canaliculatis vix alatis; foliolis subcoriaceis supra viridibus subtus pallidioribus utrinque sparse pilosis vel glabrescentibus ovatis basi cuneatis vel angustatis, margine integris leviter revolutis, apice obtusis vel acutis vel mucronatis, costa, nervis atque venis reticulatis utrinque prominentibus, paniculis parce pilosis quam folia longioribus laxe ramosis, ramis gracilibus ultimis brevibus, axillaribus et terminalibus, bracteis brevissimis subulatis; floribus pedicellatis pentameris vel hexameris, calycis segmentis brevissimis ovatis margine pilosis, petalis oblongis pallide luteis, disco in floribus masculis 5- (vel 6-) crenato; drupa parva subglobosa compressa rubescens, mesocarpo succulento.

Height of plant rarely up to 6 feet, often scrambling. Petiole 1·2–2·5 cm. long.
Terminal leaflets usually 3½ cm. long (sometimes up to 5·4 cm.); average breadth about 2·2 cm.
Lateral leaflets usually about one-third shorter.
Lateral panicles up to 8·5 cm. long; terminal up to 17 cm. long. Floral bracts ½–¾ mm. long.
Pedicels ¾–1½ mm. long. Sepals about ¼ mm. long. Petals about 1¼ mm. long.
Drupe 3–3½ mm. in greatest diameter and about as high.



Rh. nebulosa Schonl. Galpin 2853. Upper side.

Distribution: Sandhills and coast bush from Port St. Johns to Durban at low altitudes, rarely up to 150 feet; also at Inanda.

Port St. Johns, Ap. (fl.), Galpin 2853, Miss Wood 48, 74, Schonland 4049, 4099; Embotye, near Pondoland coast, Fraser (5106); near Durban, Sutherland 22, Schlechter 2858 (fr.), Drége in Herb. Kew (named *Rh. pyroides* Burch. c.), Rudatis 1655; Inanda, Wood 905, 894; Natal, Gerrard 354, 529.

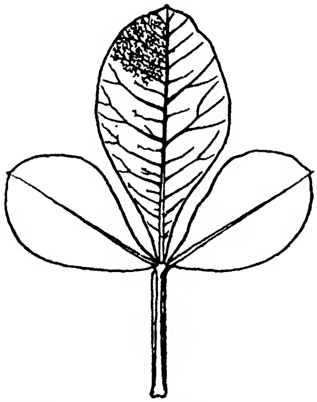
9. **Rh. krebsiana** Presl Bot. Bem. 41 (name only); Engler l.c. 409; Diels l.c. 573.

Description: A perfectly glabrous shrub (or, according to Engler, young branchlets minutely puberulous), with somewhat corrugated branches and angular branchlets more or less tinged with red. Leaves petiolate; petioles often attaining two-thirds the length of the terminal leaflets, somewhat angular, furrowed and often slightly winged above. Leaflets sessile, subcoriaceous, oblong or oblong-obovate, at the apex obtuse or slightly emarginate, often with a small mucro, at the base cuneate (the terminal one much narrowed, often subpetiolulate), the lateral somewhat asymmetrical; margin entire, slightly revolute; midrib and the much branched lateral veins slightly sunk on upper surface, prominent on lower surface, tertiary veins reticulate and distinct on both surfaces. Panicles lateral, lax, barely as long as the leaves; flowers pedicellate; bracts very minute, subulate. Calyx lobes oblong-triangular subacute. Petals oblong. Immature drupe subglobose.

Length of petioles 2–3 cm.; terminal leaflets 3–6 cm.; lateral leaflets 2–3·2 cm.
Breadth of terminal leaflets 1·5–2·5 cm.; lateral leaflets 1·5–2 cm.
Length of inflorescences 3–6 cm.; pedicels 1½–2 mm.
Length of calyx lobes 1 mm. } teste Engler.
Length of petals 2 mm..... }

Distribution: The type is without locality, but the species has recently been re-discovered in Griqualand East.

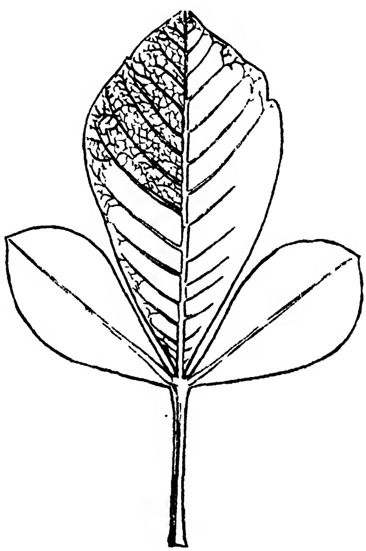
Krebs in Herb berol.; Tyger Vley in fringing forest on a hillside stream Mt. Currie distr., 4500, July (young fr.), O.B. Miller, D 312—Specimens with young flowers were collected in March.



Rh. krebsiana Licht. Krebs. Upper side.

10. **Rhus dura** Schonl. n. sp.

DESCRIPTION: Frutex ad 3–4 m. altus ramis subteretibus brunneis sparse pilosis, foliis petiolatis, petiolis foliolis brevioribus sparse tomentosis supra canaliculatis anguste alatis; foliolis glaberrimis coriaceis supra nitidis saturate viridibus subtus pallidioribus ovatis vel late oblongis vel obovatis basi angustatis vel cuneatis apice obtusis vel acutis breviter mucronatis vel rarius emarginatis, margine integris vel apicem versus leviter et irregulatiter crenatis vel dentatis vel profunde crenatis; costa, nervis et venis valde reticulatis utrinque prominentibus; paniculis sparse tomentosis ex axillis foliorum superiorum lateralibus et terminalibus foliis vix aequantibus, floribus ignotis. Drupae pedicellatae subglobosae nitidae.



Rh. dura **Schonl. Evans (5070). Upper side.**

Petiole 1·1–3 cm. long.
Terminal leaflet up to 6·5 cm. long; about 3 cm. broad.
Lateral leaflets generally half the length of the terminal leaflets.
Drupe 3–3½ mm. in diameter.

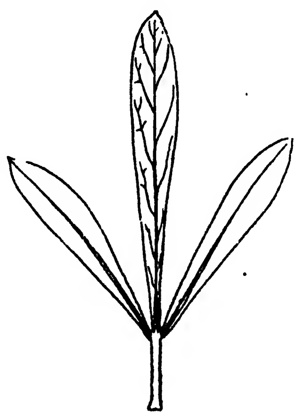
DISTRIBUTION: Only known from Graskop, near Pilgrims Rest, Transvaal, at an altitude of 4,800 feet.

Forester Evans, who collected fruiting specimens in January (No. 5070 in Herb. Alb. Mus.), states that it is common and 10–12 feet high; further, that the fruit is edible and the wood tough. It is evidently closely allied to *Rh. krebsiana* and *Rh. MacOwani*, forma *Rehmanniana*, but it has more coriaceous leaves than either of them. As in the latter, the reticulate tertiary veins on both sides of the leaflets are very prominent. In many respects it resembles *Rh. polyneura* Engler et Gilg, in "Baum, Kunene—Zambesi Expedition," p. 289, but in this the flowers are arranged in dense fascicles separated by wide internodes, whereas in our specimens the flowers seemed to have been arranged fairly regularly in a lax raceme.

11. **Rhus Rudatisii** Engl. in "Pflanzenwelt Afrikas" III, 2, 217.

DESCRIPTION: Caulis efoliatus lignosus repens ramulis erectis aggregatis basin versus efoliatis pubescentibus sursum villosis dense foliosis subteretibus; folia petiolata villosa deinde pilosa, foliolis oblanceolatis vel anguste oblongis apice acuminatis vel mucronatis membranaceis costa et nervis lateralibus paucis adscendentibus parum ramosis utrinque parum prominentibus. Paniculae laxae pauciflorae laterales quam folia breviores et terminales foliis paullum superantes. Flores pedicellati bracteis subulatis calycis segmentis obtusis ovatis extus pilosis, petalis flavis subtriplo longioribus oblongis.

Branches up to 30 cm. long.
The lowest leaves are smaller than those in the middle of the branches and the size decreases upwards again.
In the middle of the branches the length of the terminal leaflet varies from 3½–4·8 cm.
The petiole may reach a length of 1·4 cm.
In one flowering branch the leaves are very much reduced in size.
Petals evidently about 2 mm. long.



Rh. Rudatisii Engl. Rudatis 698. Lower side.

Only known from one locality in Natal—Friedenau, Umgaye flats, Alexandra county, c. 600 m. Natal, Sep., grazed pastures, fl. yellow, Rudatis 698. Type in Herb. Berlin.

Judging by nervation of leaves and the inflorescence I would place this near *Rh. pyroides* Burch. var. *puberula*, but it is very distinct. When more material is available a transfer to another group, perhaps next to *Rh. fastigiata* may be desirable.

DENTATA group.

12. **Rh. dentata** Thunb. (Synonyms: see below.)

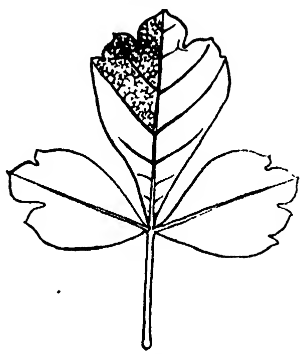
This is an extremely variable species and forms a curious parallel to *Rh. mucronata* Thunb., not only on account of its polymorphism but also because it includes quite glabrous, more or less pilose and villous forms.

The amount of hairiness here cannot be used as specific or varietal distinctions. I have used it to distinguish different forms. The form and size of the leaves again is very variable, but as these variations to a certain extent are geographically circumscribed (though this applies to a certain extent to the forms also) I have used them to form three varieties, but sharp distinctions between them cannot be given, though extreme forms are easily recognized.

The division of the species would then be :—

A. *typica* : *α genuina*, *β pilosa* ; B. *parvifolia* : *α glabrescens*, *β pilosissima* ; C. *grandifolia* : *α glabra*, *β pilosa*, *γ pilosissima*.

Then there are a number of forms which do not fit in with such a scheme of classification. In most cases they are intermediate between *Rh. dentata* and other well-known species, and there can be no reasonable doubt that they are hybrids.



Rh. dentata Thunb., A. *typica α genuina*. Fourcade 965. Under side.

Engler (l.c. 435) has separated *Rh. Sonderi* from *Rh. dentata*. It coincides to a large extent with C. *grandifolia*. The leaflets are, according to Engler, not albo-marginate. This, I find, is not always the case. This character is also variable in typical *dentata*. He further states that the petals are barely over 1 mm. long. I find them $1\frac{1}{4}$-$1\frac{1}{2}$ mm. long. In A. *typica* they vary in length from $1\frac{1}{2}$–2 mm., so that it seems better to sink again *Rh. Sonderi* in *Rh. dentata*. I must also unite with it *Rh. parvifolia* Sond., *Rh. truncata* Schinz, *Rh. Galpinii* Schinz (non Engl.), and *Rh. acutidens* Engl.

Distribution : In the coast districts from the Humansdorp division to Natal, on the eastern mountains, and in the Transvaal.

A. *typica*—

Description : A perfectly glabrous or more or less pilose or villous shrub, unarmed or subspinous with short rigid or sometimes slender, slightly furrowed subterete branchlets. Leaves petiolate, petioles slender, $\frac{1}{2}$–$\frac{3}{4}$ the length of the terminal leaflets, narrowly canaliculate above. Leaflets thin, membranous, deep green above, lighter below, often subplicate, sessile, obovate, usually coarsely crenato-dentate in the upper part, rarely subentire or entire, teeth mucronate, the entire base of the leaflets cuneate ; margin flat, sometimes white-margined ; midrib slightly sunk above, somewhat prominent below, lateral veins immersed above and slightly prominent below, rarely also above, tertiary veins reticulate,

immersed. Panicles loose, the axillary generally shorter than the leaves, the terminal slightly longer, bracts subulate, small, pedicels longer than the flowers. Calyx lobes triangular, petals oblong. Drupe more or less red, shining, subglobose, slightly depressed.

Length of petioles about 1·5 cm.; terminal leaflets usually 2–2·5 cm.
Breadth of terminal leaflets usually about 1·7–2 cm.
Lateral leaflets one-half to two-thirds the size of the terminal leaflets.
Length of pedicels about 2 mm.; calyx lobes about ¾ mm.; petals 1½–2 mm.
Diameter of drupe about 4 mm.

α genuina—Perfectly glabrous. *Rh. dentata* Thunb. in Fl. Cap. ed. Schultes 265; *Rh. cuneifolia* E. Mey. in Drège exsicc.

DISTRIBUTION: From the Storms River to Bothas Hill, near Grahamstown, and on the eastern mountains to Stutterheim.

Herb. Thunberg, Upsala; Storms River, 250 feet, Nov. (fl.), Schlechter 5984; Witte Els Bosch flats, 700 feet, Fourcade 2198; Oudebosch flats, Fourcade 965; Suku, Humansdorp division, Burchell 4819 (many leaves entire or subentire); Hofman's bush, Humansdorp division, thick scrub at foot of kloof, Britten 1175; Kleinfontein, near Hankey, common, J. Sim 159 (many leaflets acuminate and with very small teeth); Gamtoos River, Schlechter 6057; Van Stadens Mountains E. et Z. 1126, Ecklon 21; between Grahamstown and Assegai bush, Ecklon 368 (wrongly distributed as *Rh. tridactyla* Burch.); ib. Z., 2231; Bothas Hill, near Grahamstown, Dyer , MacOwan 281; Boschberg, near Somerset East, MacOwan 281 bis; Cambedoosberg, Drège ("Rh. dentata Thunb. b"), Bedford, Mansell Weale 870; Katberg, Staples (5020) [partly with longer petioles than the type]; Quaku forest station (4480); edge of Mkubiso forest, common, Stayner 37.

β pilosa.—Sparingly pilose on the branchlets, panicles, petioles and young leaflets (especially veins) and calyx, sometimes also on older leaflets.

DISTRIBUTION: From Van Stadens to Umtata, also on the Amatola Range, Maclear district, Fouriesburg, Orange Free State, Barberton and Pilgrims Rest districts, Transvaal.

Amongst bushes on the Van Stadens Mountains, Z. 2231 bis; Grahamstown, 1,900 feet, Schlechter 2639; 3 miles north-west of Grahamstown, 4–5 feet high, 2,000 feet, Dyer 210 (one branch quite glabrous); Tarka River, Kabousie, Cooper 274; Hogsback, Rattray 236; Stutterheim, 3,000 feet, Hunter (5033), ib., Woodcock (5009); Komgha, 2,000 feet, Schlechter 6168; ib., Flanagan 656; slope towards the Umtata waterfall, scattered, not more than 4 feet high, Schonland 3835; Cala, Royffe 183; Surat, Maclear, Britten 4564; mountain sides, Fouriesburg, Orange Free State, 6,200 feet, Potts 1955 ("leaves deciduous"); Barberton and Pilgrims Rest districts, common, Keet 1455.

B. *parvifolia* (*Rh. parvifolia* Harv. in Fl. Cap. I, 510); *Rh. mollis* E. Mey. in Drège exsicc. *Rh. truncata* Schinz in Bull. de l'herb. Boiss. Ser. II, viii, 86.

Leaflets smaller than in A. and generally not so deeply incised or even sometimes entire, sometimes distinctly truncate and slightly emarginate (*Rh. truncata* Schinz), terminal usually 10–15 mm. long, petiole usually slightly under 10 mm. long.

DISTRIBUTION: Queenstown district to Natal and the Transvaal.

α glabrescens.—Leaflets glabrous or sparingly pilose.

Rocky places on the Insiswa Mountain, Griqualand East, 2,300 m., Schlechter 6465 (type of *Rh. truncata* Schinz); Colenso, 3,200 feet, Schlechter 6882; Moorddrift, Transvaal, Leendertz 2265; Umbombola Range, 4,000–4,400 feet, shrub 3 feet, Galpin 2190, and the following in Herb. Kew: Natal, 3,500–4,000 feet, Sutherland; Natal, Gerrard 1400; Umgeni waterfall, Cooper 2169.

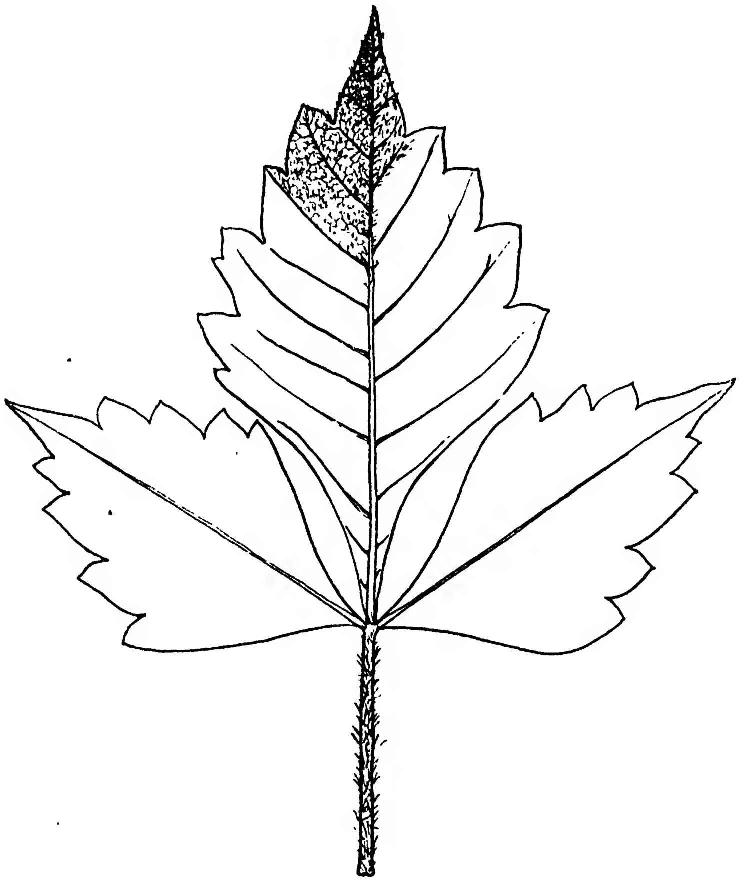
β pilosissima.—Leaflets retaining a covering of soft longish hairs.

Fincham's Nek, Queenstown, Galpin 2204; hillside near junction of Kei Rivers, district Queenstown, 2,350 feet, shrub 3 feet high, Galpin 8099; Tabase, Transkei, 2,500 feet, Baur 333; Mvenyani, Cedarville, Griqualand East, Bandert 42; Ingungo, 3,000 feet, Schlechter 6311; Mooi River, 6,000 feet, Schlechter 3348 (Wood 1035 in Herb. Berol. and Kew, and Rehmann 4743 in Herb. Berol.).

C. *grandifolia*—

DESCRIPTION: Young axial structures and petioles softly shaggy pubescent, rarely glabrous. Leaflets generally retaining a covering of soft hairs, especially along midrib, lateral veins and margins, more rarely plant subglabrous or quite glabrous. The leaves

are generally two to three times the size of the average in A., but no sharp distinction can be drawn. With the increase in size of the leaves the petioles often become absolutely and relatively longer. The general outline of the leaflets, although variable, resembles A as a rule (*Rh. Sonderi* Engl.). There is, however, a tendency to form acute apices, and sometimes the leaflets are almost lanceolate (*Rh. Galpinii* Schinz, in Bull, de l'herb, Boiss Ser. II, VIII, 638 Galpin 646 from Barberton [non Engl.] = *Rh. dentata* var. *acuminata* Burtt-Davy Ms.). .



Rh. dentata Thunb., C. *grandifolia*, γ *pilosissima*. Fraser (5039). Under side.

DISTRIBUTION: Chiefly on the outside of forest and in swampy ground from eastern Cape Colony to Natal, the eastern Orange Free State to the northern Transvaal.

a glabra.—Quite glabrous.

Ntsubane, 10 miles from Lusikisiki, 5 miles from coast on Table Mountain sandstone, fairly common, 1,800 feet, Fraser (5048); Ingwangwane, P.O. Riverside (4484); Weza forest reserve, 14 miles from Harding, Sallender (5044), 5045 p. pte.; Ladybrand, Rogers 791; between Greytown and Newcastle, Wilms 1921; Alexandra county, Rudatis 1149.

β pilosa.—Pilose, leaflets glabrous or glabrescent (largely = *Rh. Sonderi* Engl. var. *pilosa* Engl., e.g. Schlechter 6990), and *Rh. dentata β puberula* Sond.

East London, Rattray 169; Kentani district, 1,200 feet, fragrant shrub, 1–5 feet, Pegler 900 p. pte.; Amanzamnyanu, Mt. Frere, 3,000 feet, common on hillside, Van der Merwe (5104); Dlokolyana forest, East Griqualand, 4,500 feet, average height 20 feet, common (5046, 5072); Insizwa, 6,000 feet, Schlechter 6525; Howick Falls, Rogers 546; Weza forest reserve, near Harding, c. 4,000 feet, Sallender (5045 p. pte.); Van Reenen, 5,600 feet, Schlechter 6990 (the specimens in Herb. Alb. Mus. are evidently coppice shoots with very large leaves, petioles up to 5·5 cm. long, terminal leaflets up to 8·5 cm. long); near Lydenburg, Burtt-Davy 7642, 5328; Graskop, northern Transvaal, Evans (5108*a*); ib., branch with juvenile foliage which is very large, similar to Schlechter 6990, Graskop, Evans (5095); Fouriesburg, Dunelm farm, on mountain side, shrub 3–5 feet, Potts 3106; scattered over the mountain, Ladybrand, Patterson (5136). There is a sterile branch in Herb. Alb. Mus. which agrees with many other specimens in Herb. Alb. Mus. and a fruiting branch in which the leaves do not differ much from A. *typica*, but the panicles are much longer (up to 7 cm.).

γ pilosissima.—Leaflets retaining largely a covering of soft longish hairs.
Congcane, 14 miles north-north-east of Qumbu, Transkei, Dwyer (5113); common in the neighbourhood of Lusikisiki, Pondoland, Fraser (5037, 5039); Ingwangwane, P.O. Riverside, (4482); Ladysmith, Natal, Rogers 694 (leaflets with a more obtuse outline than is generally the case); Pretoria, Rehmann 4743 (petioles very variable in length from over 1 cm. to 5·2 cm.); Ermelo, Tennant 6938; Elands spruitberg, 1,730 m., Schlechter 3390; Mavieristad, Pott 4933.

The separation of var. C. *grandifolia* into the forms here distinguished, being quite artificial and not adopted until my return from Europe, a few of the following in Herb. Kew may have to be readjusted. Some may even have to be placed under A; others are almost certainly hybrids.

β pilosa—
Zuurbergen, Drège (marked *Rh. crenata* Thunb. ?), cotype of *Rh. dentata β puberula* Sond. (young axial organs and petioles pilose, also midrib and margin of leaflets, otherwise surface of the latter sparsely pilose); Burchell 4171, 4607; Shiloh, 3800, Baur 894; Br. Caffraria, Cooper 275, 422 (this and the following very much like *Rh. Galpinii* Schinz); Natal, Gerrard 762; Inanda, Wood 1140; Phillips, Bethlehem 3158, 3161; The Downs, Pietersburg, Rogers 22039 (agrees closely with *Rh. acutidens* Engl.); Limpopo sources, Nelson 515 (like *Rh. Galpinii* Schinz.).

γ pilosissima—
Basutoland, Dieterlen 76 *a* and *b*, Cooper 2171; Orange Free State, Cooper 850; Hoogeveld, Page's Hotel, Transvaal, Rehmann 6863; Charlestown, Natal, Mogg 9655.

HYBRIDS: There can be no doubt that *Rh. dentata* hybridizes freely with *Rh. Legati*. Such evident hybrids can be readily detected by the practised eye in the field, but cannot always be detected with certainty in herbarium specimens, and no doubt some of the specimens enumerated above are hybrids, e.g. those referred to *Rh. Galpinii* Schinz and *Rh. acutidens* Engl. l.c. 423; Diels l.c. 578,623.

Rh. grandidens Harv. Gerrard 1399. (A hybrid ?)

Rh. acutidens Engl. Rehmann 5558. (A hybrid ?)

Rh. dentata Thunb. Schlechter 3642. Under side. (A hybrid ?)

A hybrid of *Rh. dentata* ? Woodcock 4471. Upper side.

Rh. dentata X _Legati_.—Common on the Katberg, Amatolas, and near Grahamstown: terminal leaflet often petiolulate, leaflets very irregularly dentate, axillary panicles much longer than the leaves, e.g. Dyer 746*a* and *b* (Katberg), Woodcock (5010), Kubusie, Stutterheim, Dyer 409 (Howiesons Poort).

Rh. dentata X *pyroides* var. *puberula* (an *fastigiata* ?).—Leaflets with a few acute teeth (usually only in the upper half), cuneate from near the apex to the base, petioles often under 1 cm. long, terminal leaflet 1·5–2 cm. long. A rambling shrub, about 8 feet high, under common yellowwood, fairly plentiful, Upper Kubusie, Stutterheim district, 3,300 feet, Woodcock (4471). The hybrid nature of this curious form (the leaves of which often resemble those of *Rh. acutidens*) may also be concluded from the fact that only sterile flowers with abortive stamens and no ovaries were found. In some flowers the calyx lobes were 1 mm. long, in others 1¼–1½ mm. Another specimen, which is like *Rh. acutidens* Engl., is Moss 8324, from Witpoortje Kloof, near Johannesburg. Prof. Moss noted on the label: "*Rh. dentata* X *pyroides* (me judice)." Here the anthers were fully developed. Another evident hybrid is *Rh. grandidens* Harv. Ms. in Herb. Kew; Engl. l.c. 440; Diels l.c. 587. It was described from Gerrard No. 1339 in Herb. Kew. It has glabrous leaflets which are narrowly lanceolate, very acute and usually [not always, as Engler stated] provided with a few acute teeth above the middle. Flowers and fruits are unknown. Rudatis 1310, from the Umgaye Flats, Alexandra county, in the Berlin Herb. is very similar. The following notes were taken from it:—A much branched small shrub, 3–6 feet high, with ascending densely leafy branches. The young branches, petioles and petals are pubescent. The leaflets are subglabrous and have revolute margins. The midrib is slightly sunk above, prominent below, the lateral veins often prominent above and usually prominent below, arising at rather an obtuse angle. The specimen has flowerbuds, which are rather large for the genus. They are arranged in dense lateral pyramidal panicles which are shorter than the leaves.

13. **Rh. carnosula** Schonl. n. sp.

Rh. laevigata L. β foliis latioribus grosse dentatis in Drège exsicc. 5569; *Rh. laevigata* Thunb. β *dentata* E. Mey.; Sonder l.c. 514.

Differs from *Rh. laevigata* Thunb. (non Linn.): Flowers larger; panicles always terminal and lateral in the axils of the upper leaves; styles frequently persisting even when the drupes are ripe; leaflets thicker, slightly fleshy, frequently coarsely dentate, lateral veins thicker and more prominent. Merges near Grahamstown into some forms of *Rh. dentata* in the shape and dentition of the leaflets. Probably also closely allied to *Rh. eckloniana.*

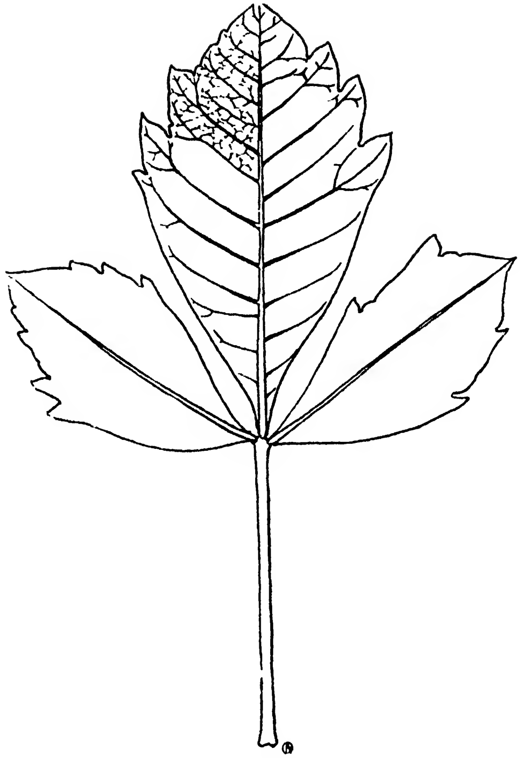
Description: Frutex glaberrimus 2–15′ altus ramulis gracilibus teretibus. Folia petiolata petiolis supra canaliculatis. Foliola carnosula subcoriacea, sessilia vel terminalia petiolulata, oblonga vel subovata basi cuneata apice acuta vel acuminata mucronata; margine plana saepius albocincta, parte superiori ± grosse dentata, dentibus oblique subcrenatis vel oblique triangularibus mucronatis vel integra; costa venisque supra vix prominulis infra costa valde prominenti venis prominulis, nervis utrinque vix prominulis. Paniculae multiflorae axillares quam folia breviores, terminales longiores, bracteis parvis anguste lanceolatis acutis, floribus pedicellatis. Calycis lobi subovati subacuti vel obtusi. Petala oblonga. Drupa nitida subglobosa stylis saepius persistentibus.

Length of petioles 2–3·5 cm.; terminal leaflets 5–7 cm.; lateral leaflets three-quarters to five-sixths of terminal leaflets.
Breadth of terminal leaflets usually 2 cm., sometimes nearly 3 cm.
Breadth of lateral leaflets slightly less than terminal leaflets.
Length of pedicels 1–2 mm.; calyx lobes about ¾ mm.; petals 1½–2 mm.
Diameter of drupe about 5 mm.

Distribution: From Howiesons Poort, near Grahamstown (where, however, it is not quite typical), along the coast to Pondoland.

A. *typica*—

Gekau, Drège 5569; East London, Rattray 177 (=Bolus 8839 in Herb. Bol.); Keimouth, 1,000 feet, Schlechter 6212; amongst coarse valley vegetation, 2–3 feet, Feb. (young flowers and fruit), Kentani, 1,000 feet, Pegler 225; Eastgate S. Johns, Schonland 3944; Ntsubane forest station, Lusikisiki, Pondoland, Fraser (5080) [one branch with entire leaves]; ib., Fraser (5146) [one branch with small leaves, terminal leaflet not exceeding 4 cm. in length]; ib., Fraser (5152) [with ovate leaflets]; Notensila forest station, Pondoland (5038); Pondoland, Bachmann 69 in Herb. Berol.



Rh. carnosula Schonl. (5038). Under side.

B. *longipetiolata.*—Leaflets about the average size and shape of the typical form, but with much longer petioles (4–6 cm.).

East London, Rattray 170 (some leaves have a fourth, small leaflet); 8 miles east of East London, Dyer 1985 (not bushy, 2–4 feet high); Komgha, 2,111 feet, Rogers 3309; slope towards Umtata waterfall, shrub 15 feet high, scattered, Schonland 3836; Embotye, Pondoland, Fraser 73/16/B (5100*a*); Ntsubane, Fraser 5145, 5149.

C. *parvifolia.*—Leaflets smaller than in the type with slightly prominent whitish lateral veins on the upper surface.

Ntsubane and other places a few miles from the sea in Pondoland, Fraser (5053, open veld, sandy soil often swept by fire, height about 2 feet), (5151), (5081).

The specimens from Grahamstown referred to above, e.g. Dyer 196, have the lateral veins of the leaflets only very slightly prominent on the surface or they are quite immersed, the flowers are smaller (calyx lobes $\frac{1}{2}$–$\frac{3}{4}$ mm. long, petals $1\frac{1}{4}$ mm. long), fruits also smaller than in the type.

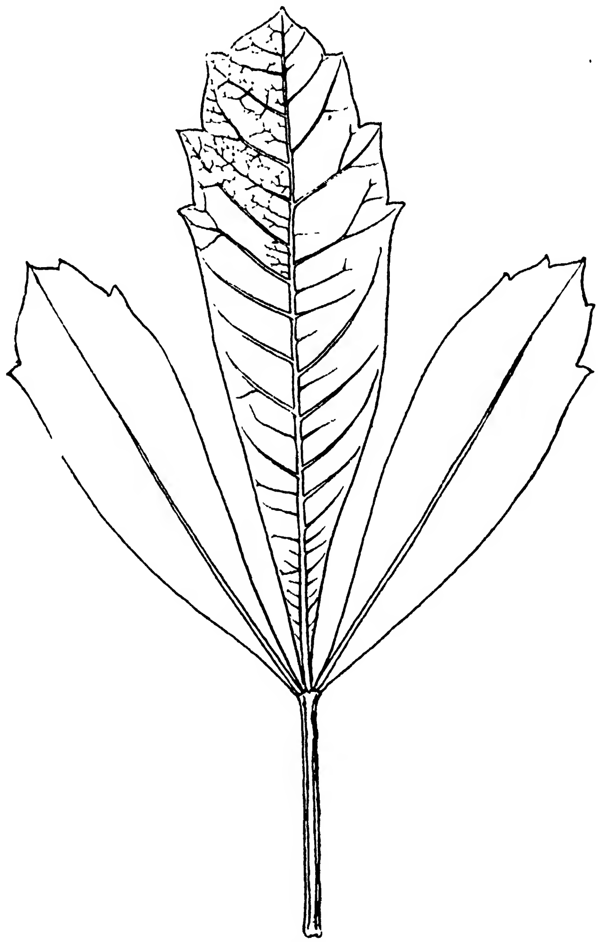
Hybrids: Perhaps the plants with very long petioles may be hybrids with *Rh. Legati* Schonl. (*Rh. laevigata* Thunb.). Hybridization with *Rh. dentata* Thunb. is also suspected.

14. **Rh. Rogersii** Schonl. n. sp.

Description: Frutex fastigiatus 3–4′ altus ramulis novellis subteretibus striatis pilosis. Folia petiolata petiolis striatis pilosis supra late canaliculatis subalatis. Foliola subcoriacea sessilia oblonga infra medium cuneata vel totius cuneata, juvenilia dense et breviter pubescentia, adulta glabrescentia vel glaberrima, supra saturate viridia subtus valde pallidiora; ad margines leviter revoluta, basi usque ad medium vel ultra integra, parte superiori ± grosse crenato-dentata dentibus mucronatis; costa venisque utrinque

prominulis nervis reticulatis immersis. Paniculae multiramosae multiflorae leviter pilosae vel glabrae laterales and terminales quam folia breviora vel longiora bracteis parvis lanceolatis, floribus breviter pedicellatis. Calycis lobi inaequales subovati subacuti vel obtusi. Petala oblonga. Drupa immatura subglobosa.

Length of petiole about 2·5 cm.
Length of terminal leaflets 8–10 cm. (generally); lateral leaflets 4–9 cm. (generally about 7·5).
Breadth of terminal leaflets about 3 cm.; lateral leaflets about 2 cm.
Length of pedicels 1–1¼ mm.; calyx lobes about ½ mm.; petals about 1¼ mm.



Rh. Rogersii Schonl. Rogers 18270. Upper side.

DISTRIBUTION: Barberton district and Swaziland.

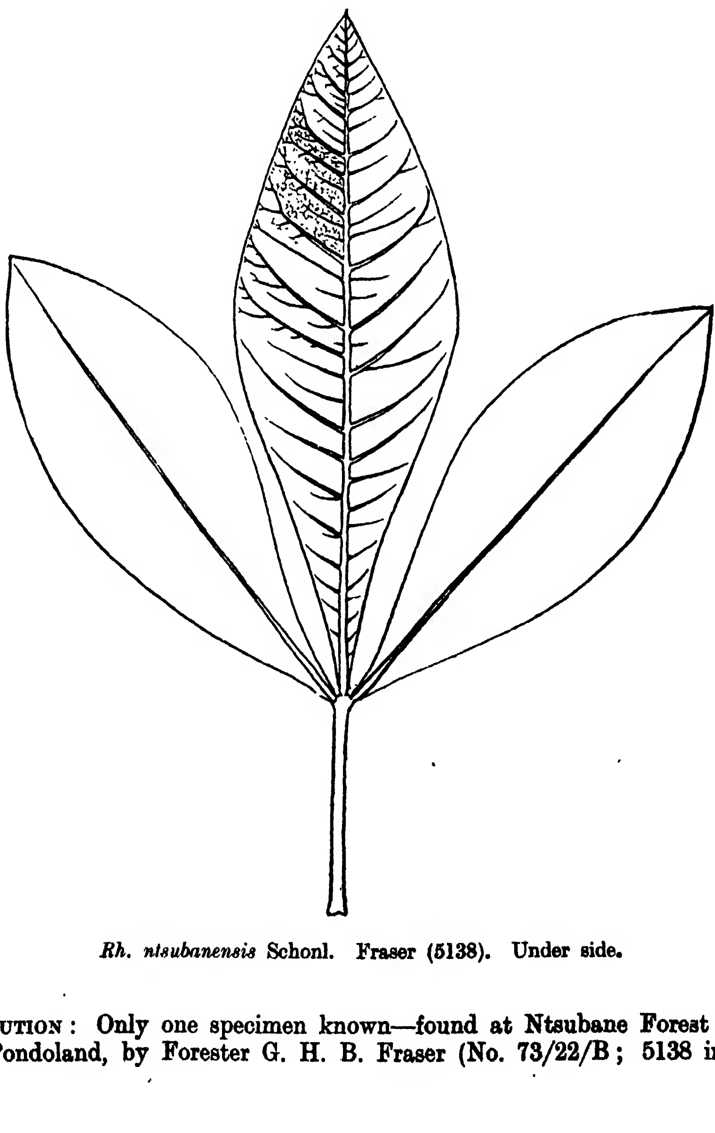
Barberton, 3,000 feet, Dec. (fl.), Rogers 18270; "Hilltop", Barberton, in scrub forest on granite soil, Nov. (fl.), Keet 1454 ("a small bush, 3–4 feet high, common at this locality, and seen also along kranses at Berlin, in the same district, at elevations up to 5,000 feet"); Berlin forest reserve, on the edge of the great escarpment, Barberton division, c. 4,000 feet, Apr. (young fr.), Keet (5165); Godwan River, Swaziland, Feb. (fl.), Jenkins (Transvaal Mus. herb. 10370).

The female inflorescences are longer and looser than the male as far as is shown by the available material.

16. Rh. ntsubanensis Schonl. n. sp.

Description: Frutex parvus ramis juvenilibus subteretibus glabris lenticellis numerosis orbicularibus prominentibus tectis. Folia petiolata petiolis glabris vel subglabris supra canaliculatis subalatis. Foliola glabra sessilia oblongo-ovata basi cuneata apice acuta vel subacuta saepius plicato-mucronata, facie undulata, supra saturate viridia subtus glauca, margine integra; costa venisque supra vix prominulis, subtus conspicue prominentibus nervis paucis reticulatis immersis. Paniculae glabrae laxae valde ramosae. Flores ignoti. Drupa subglobosa nitida primum rubriuscula carnosa deinde subatra.

Length of petioles about 2 cm.; terminal leaflets 7–8 cm.; lateral leaflets 6–7 cm.
Breadth of terminal leaflets about 3 cm.; lateral leaflets about 2·7 cm.
Diameter of drupe 4–5 mm.



Rh. ntsubanensis Schonl. Fraser (5138). Under side.

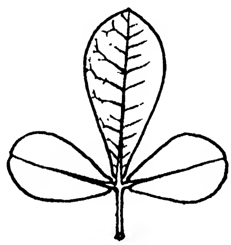
Distribution: Only one specimen known—found at Ntsubane Forest station, near Lusikisiki, Pondoland, by Forester G. H. B. Fraser (No. 73/22/B; 5138 in Herb. Alb. Museum).

REFRACTA group.

16. **Rh. refracta** E. et Z. in Enum. 1103.

Description : A much branched, often thorny shrub, reaching a height of 8–9 feet, branchlets often nearly horizontal, subterete, grey or pale rufous villous. Leaves petiolate, petioles subterete, flattened or slightly furrowed above, leaflets rigidly membranous, dark green above, paler below, when young villous, later sparsely pilose on both surfaces, often corrugated, obovate-cuneate, obtuse or a little emarginate or mucronulate at the apex, margin slightly revolute, entire or rarely crenulate in the upper part, midrib and the few lateral veins usually sunk in the upper surface of the leaflets, slightly prominent on the lower, tertiary veins few and usually not visible in dried specimens. Panicles axillary and terminal, greyish villous, laxly branched, longer than the leaves. Bracts very minute. Sepals subovate, pilose on the outside. Petals oblong. Drupe somewhat fleshy, subglobose, slightly depressed above, blackish with a greyish bloom.

Length of petiole 7–10 mm................
Length of terminal leaflets about 1·2–2·2 cm.
Length of lateral leaflets about 7–10 mm..... } Somewhat larger in some forms growing near the sea.
Breadth of terminal leaflets about 1 cm......
Breadth of lateral leaflets about 5–8 mm.....
Length of male panicle about 7 cm. ; pedicels about 1 mm.
Length of calyx lobes about ½ mm. ; petals about 1¼ mm.
Drupe : height about 3½ mm., breadth and depth about 4 mm.



Rh. refracta E. et Z. Dyer 211. Under side.

Distribution : In dry open scrub from the Knysna division to Natal (?) from near sea-level to an altitude of about 2,000 feet.

Blaauwkrantz forest reserve, Knysna division, 1 mile from sea, 200 feet, Zahn 5040 ; in the forests of Addo and by the Zwartkops River, E. and Z. 1103, Z. 14, 87 ; common in the neighbourhood of Grahamstown, Schonland 3301, 4477, 4478, Dyer 162, 211, Rogers 27671, Britten 1504 ; Blaauwkrantz, Britten 2738 ; Lushington valley, May, Schonland 5169 (fr.) ; Kareiga R. forest, Britten 2498 ; Port Alfred, Tyson 50, Schlechter 2735, Britten 1883, 1828 [Port Natal, Gueinzius, Sanderson—teste Sonder l.c. 511].

In many respects this species approaches *Rh. MacOwani* ; in fact, it looks like a small-leaved form of it, but its leaflets have not got reticulate venation and inflorescences, flowers and drupes are different.

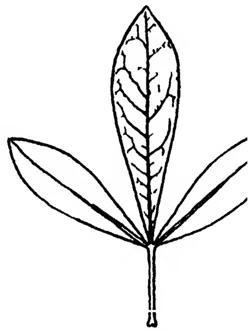
17. **Rh. fastigiata** E. et Z. in Enum. 1107.

Rh. puberula E. et Z. var. *fastigiata* Sonder l.c. 511 ; Engler l.c. 427.
? *Rh. sericea* E. et Z. in Enum. 1105.
Rh. humilis E. et Z. in Enum. 1108.

Description : Much branched bush, 2–9 feet high, with slender terete branchlets, which, like the leaflets, petioles and branchlets, are shortly adpressed pubescent. Leaves petioled ; petiole subsemiterete, furrowed above. Leaflets dark green above, paler green on lower side, subcoriaceous, oblong-acute or elliptic-lanceolate narrowed at the base, sometimes obtuse or mucronulate, mucro often plicate, surface in adult leaflets often subglabrous, margin entire narrowly revolute ; midrib slightly prominent on upper surface, more so on lower ; lateral veins few, slightly prominent above, more so on lower surface, slightly branched towards the margin of the leaflets. Panicles very lax, lateral in the axils

of the upper leaves (shorter than the leaves) and terminal about as long as the leaves. Bracts very small. Calyx lobes broadly ovate, very obtuse, very pale greenish white. Petals oblong, very pale yellowish white. Drupe subglobose, glabrous.

Length of petiole 5–8 mm.; terminal leaflets 2–3 cm.
Breadth of terminal leaflets 4–8 mm. Lateral leaflets about two-thirds the size of the terminal.
Length of pedicels 1–2 mm.; calyx lobes barely ½ mm.; petals about 1½ mm.
Diameter of drupe 3–3½ mm.
Gane 325. from the "Mayor's Seat" near Grahamstown, has perfectly hermaphrodite flowers.



Rh. fastigiata E. et Z. MacOwan 766. Upper side.

DISTRIBUTION: In the coast districts from the Uitenhage division to Natal, extending inland to the Katberg and Amatola mountains.

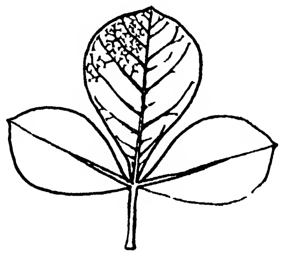
No absolutely sharp line separates this species from *Rh. pyroides* Burch. (non Sond. nec Engler) var. *puberula*, but the absence of reticulate venation (except in coppice shoots) in *Rh. fastigiata* defines it sufficiently. The leaflets of *Rh. fastigiata* are shorter and narrower than in *Rh. pyroides*, but this difference becomes less in coppice shoots of the former. The lateral veins are generally much more distinct in *Rh. fastigiata*. The fastigiate habit cannot be used as distinguishing character, but is common in the species.

Uitenhage and Albany districts, E. et Z. 1107; Addo hills, E. et Z. 1108 (*Rh. humilis* E. & Z.); Z. 887; Van Stadens, Paterson 1987; Zuurberg, Paterson 18; very common in the neighbourhood of Grahamstown, especially south of it, MacOwan 265, 766, Britten 2807, 5171, 5172, 5173 (coppice shoot), Salisbury 208 (not typical: leaflets more leathery, petioles only about 3 mm. long, lateral veins often not distinct; perhaps *Rh. fastigiata* x *lucida*), Z. 2239, E. 887 (from the neighbourhood of the locality of the type of *Rh. sericea* E. et Z.); Wolfridge, Amatolas, c. 5,000 feet, Hunter 5086*a*; wooded kloof, Fort Cunyngham, 3,300 feet, Galpin 2480; Komgha, 2,000 feet, Apr., Flanagan 800, Schlechter 6164; Ntsubane, near Lusikisiki, Fraser 5097; near Murchison, Wood 3126; Natal, Gerrard 1879; Burchell 4744, 4814; Drège (named *Rh. angustifolia* L. a.); Herb. Thuberg (*Rh. excisum* fol. *a*).

18. **Rh. Dinteri** Engl. in "Pflanzenwelt Afrikas". III, 2, 211, fig. 103, E. to G.
Rh. impermeabilis Dinter Ms.
Allied to *Rh. refracta*.

DESCRIPTION: A much branched thorny shrub up to about 6 feet high, with subterete pubescent or subtomentose branchlets. Leaves petiolate, petioles about half the length of the terminal leaflets or slightly longer, pubescent, slightly furrowed above. Leaflets glaucous, obovate or oblong, usually slightly plicate-mucronulate at the apex, cuneate at the base (the terminal often much contracted); margin usually entire, very slightly revolute; pubescent on both surfaces, but hairs longer on the lower surface; midrib and lateral veins slightly prominent on both surfaces, more on the lower than upper surface, lateral veins few, arcuate, slightly branched, tertiary veins distinct, reticulate. Panicles subtomentose, axillary and terminal, slightly shorter than the leaves, or the terminal ones a little longer, laxly few-flowered, flowers pedicellate. Calyx lobes ovate. Petals oblong. Drupe subglobose.

Length of petioles 6–9 mm.; terminal leaflets 1–2·2 cm.; lateral leaflets ·8–1·6 cm.
Breadth of terminal leaflets ·8–1·5 cm.; lateral leaflets ·5–1·1 cm.
Length of pedicels about 1 mm.; calyx lobes about ¾ mm.; petals about 1½ mm.
Diameter of drupe about 4 mm.



Rh. Dinteri Engl. Dinter 4359. Upper side.

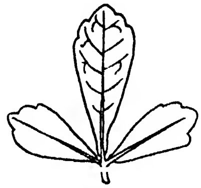
DISTRIBUTION: Restricted to the South-West Protectorate.

Schaaprivier, Mar. (fr.), Dinter 1898; Lichtenstein and Hohenwarte, Anas mountains, Dec. (fr.), Dinter 4359; between Haris and the Anas mountains, on plateau in sandy ground (young fr.), Pearson 9507 (one leaf with five leaflets).

19. **Rh. crenata** Thunb. in Fl. Cap. ed. Schultes 266, Sonder l.c. 512; Engler l.c. 422; Diels l.c. 577, 631.

DESCRIPTION: Much branched shrub, usually about 3-7 feet high, with terete, shortly greyish or rufous villous branches. Leaves shortly petiolate, petioles relatively thick. Leaflets without ordinary hairs, rigid, membranous, sessile, dark green or greyish green above, often rufous on the lower side, obovate-cuneate, margin slightly revolute, 3–5 crenate at the blunt apex, midrib and the few lateral veins slightly prominent on both surfaces, no tertiary veins. Panicles shortly villous, axillary not confined to the very apex of the branches, shorter or the male ones longer than the leaves, terminal longer than leaves, multiflowered. Bracts small, acuminate, pilose. Flowers shortly pedicellate, very often 4-merous, often 5-merous, rarely 6-merous. Calyx lobes ovate acute, pilose. Petals oblong, about three times the size of the calyx lobes. Drupe fleshy, almost black when ripe, subglobose.

Length of petioles about 2 mm.
Length of terminal leaflets 1·2–2·5 cm., but usually only 1·2–1·5 cm. and breadth in proportion.
Length of lateral leaflets ·5–1·7 mm., but usually only 1 cm., and breadth in proportion.
Breadth of terminal leaflets 5–9 mm.; lateral leaflets 6–9 mm.
Length of pedicels about 2 mm.; calyx-lobes ¼–½ mm.; petals 1¼–1½ mm.
Diameter of drupe about 4 mm.



Rh. *crenata* Thunb. Daly 1065. Under side.

DISTRIBUTION: On fixed sandhills along the coast from the Cape Peninsula to the Kei River mouth, flowering and fruiting almost throughout the year. A sand-dune fixed chiefly by *Rh. crenata* and *Myrica cordifolia* L. is figured by Marloth (Das Kapland 1908, fig. 10). The former favours the ridges.

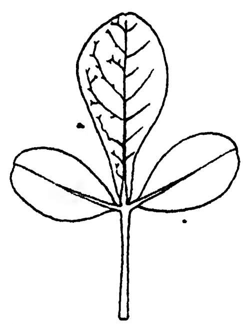
Type in Herb. Thunberg, Upsala; Burchell 5331 (only few leaves crenate at the apex); between Retreat and Diep River, Dümmer 1519; Cape Flats, about 2 miles from Eerste River, Van Roeper 5058; Wagenhuis Krans, Bredasdorp, Fry in herb. Galpin 4975; sandy places near the Onrustriver, 10 feet, Schlechter 10394; Great Brak River, 30 feet, Schlechter 5738; seashore, Plettenberg Bay, Fourcade 596; Groot River mouth, Zahn 5039; sandhills on the shore near Cape Recief, E. & Z. 1123; neighbourhood of Port Elizabeth, Ecklon 20, Paterson 1108, Cooper 1571, J. Sim 36, Daly 1065, Kemsley 316; neighbourhood of Port Alfred, Hutton 988, Burchell 3829, 3830, Britten 1910, 2751, White 61, Salisbury 130 (p. pte.); East London, Rattray 35, Galpin 5688; Keimouth, Flanagan 846.

20. **Rh. Pentheri** Zahlbr. in "Plantae Pentherianae" (Ann. Hofmus. Wien XV, 52).
Rh. cuneata N.E. Br. in Kew Bull. 1906, 17.

Zahlbruckner compares this species to *Rh. undulata* Jacq., and *Rh. krebsiana* Presl, with neither of which, however, it is allied. N. E. Brown says that *Rh. cuneata* [which must be sunk in *Rh. Pentheri*] "is allied to *Rh. crenata*, but easily distinguished because the leaves are without glands on the under surface". To my mind, it is also allied to *Rh. refracta* E. et Z.

Description: A much branched shrub up to 9 feet high, branchlets subterete cinereo-villous. Leaves petioled, petioles subterete canaliculate above, usually about half the length of the terminal leaflets, sparsely pilose. Leaflets membranous, at first covered with sparsely adpressed hairs, later glabrescent or glabrous, dark green above, paler below, elongate obovate-cuneate, apex obtuse, tridentate or emarginate, margin slightly revolute, midrib prominent on both surfaces, lateral veins very slightly branched outwards and very slightly prominent on both surfaces, tertiary veins few, coarsely reticulate, but barely visible or invisible in dried specimens. Panicles cinereo-pubescent, lateral and terminal, laxly branched, usually shorter than the leaves. Bracts minute, ovate oblong or oblong subacute, pedicels short. Calyx lobes triangular-ovate, obtuse, pubescent. Petals ovate. Drupe globose, laterally somewhat compressed and slightly depressed, shining brown when ripe.

Length of petioles 5–13 mm.; terminal leaflets 2–3 cm.; lateral leaflets 1–1·5 cm.
Breadth of terminal leaflets 4–12 mm.; lateral leaflets about ·5 cm.
Length of inflorescences 2·5–7 cm.; pedicels 1–1·5 mm.; calyx lobes about ·5 mm.
Length of petals 1·2–1·4 mm
Drupe: about 3 mm. high and about 3·5 mm. greatest diameter.



Rh. Pentheri Zahlbr. Schlechter 6301. Under side.

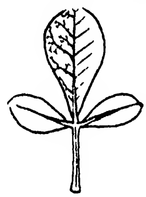
Distribution: Bashee, Pondoland, eastern Orange Free State, Natal, Barberton and Lydenburg districts of the Transvaal.

Near Colossa, Natal [Colenso ? S. Sch.], leg. Krook, Penther 2290 in Herb. Vienna; on a rocky hill near Ladysmith, 3,000 feet, Wood 5706 in Herb. Kew and Herb. Bolus (type of *Rh. cuneata* N.E. Br.); Bashee River, 2,500 feet, Schlechter 6301; Lusikisiki, Ntsubane forest station, Fraser 5163; woods near Gromberg, Natal, Wood 891; Inanda, Wood, 1319; Illovo, Wood 3106; Natal, Gueinzius, Sutherland and Gerrard 1394 in Herb. Kew; between Pinetown and Umbilo, Rehmann 8072; Umkomanzi, 1,000 feet, Schlechter 6690; Arnoldsfarm, Newcastle, Rehmann 7052; common in low forest in the Barberton and Lydenburg districts, Keet 1432 (5159), 5160, 1485.

21. Rh. divaricata E. et Z. in Enum. 1106; Sonder l.c. 508; Engler l.c. 429; Diels l.c. 582.

DESCRIPTION: A small shrub with spreading branches; branchlets terete and like the petioles minutely pubescent. Leaves petiolate, petioles about half to two-thirds of the length of the terminal leaflet, furrowed above. Leaflets subcoriaceous, sessile, ovate or obovate, obtuse and plicate-mucronulate or emarginate, the terminal cuneate at the base, margin entire or paucidentate, slightly revolute, above puberulous and with the exception of the rufescent veins dark green, below very shortly whitish or fulvous glandular tomentose eventually subglabrous; midrib and the few slightly branched lateral veins slightly prominent on both surfaces, tertiary veins very indistinct. Panicles axillary and terminal, sparsely flowered, pubescent, shorter than the leaves. Flowers pedicellate. Calyx densely pilose, segments oblong, triangular. Petals oblong, sparsely pilose. Drupe (*fide* Sonder) globose, smooth, tipped with the three styles.

Length of petioles 7–14 mm.; terminal leaflets 1·5–2 cm.; lateral leaflets 1·5 cm.
Breadth of terminal leaflets 4–6 mm.; lateral leaflets 4–6 mm.
Length of panicles 1–3 cm.; pedicels 1–3 mm.; calyx lobes nearly 1 mm.; petals 2 mm.



Rh. divaricata E. et Z. Galpin 2540. Upper side.

DISTRIBUTION: Mountains from the neighbourhood of Queenstown to Basutoland and Ladybrand, Orange Free State, also in the Transvaal (?).

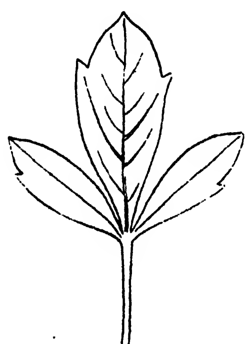
The description and measurements are taken from what I consider to be typical specimens.

Mountain sides on the Klipplaat River (Tambukiland), Alt. 5, Nov. (fl.), E. et Z. 1106, Ecklon 5 (in Herb. S.A. Mus.); Andriesberg, Jan., Galpin 2540.

There are a few other specimens which differ more or less, but which seem to have to be referred to the same species.

Aliwal North, 5–6,000 feet, Drège 6796 in Herb. Kew (leaves up to 3 cm. long). This is *Rh. subferruginata* Presl Bem.

Leribe, Basutoland, 5–6,000 feet, Dieterlen 17 (wrongly named *Rh. pyroides* Burch. in Herb. S.A. Mus.). Terminal leaflets up to 2·3 cm. long, 1·5 cm. broad. Many leaves have more or less crenate margins in the upper part. Drupe about 4 mm. in diameter.



Rh. divaricata E. et Z., var. *fulvescens* Engl. Rehmann (type).

Mountain slopes, Leribe, Basutoland, shrub, fl. white, Dieterlen 17*b* (wrongly named ***Rh. Zeyheri*** Sond.). This has remarkably slender petioles (up to 4 cm. long). The largest terminal leaflets are 3·5 cm. long. The texture, venation and pubescence of the leaflets are the same as in the type, also the flowers. The margin of the leaflets show sometimes a few crenate teeth. The leaflets are obovate, narrowly cuneate at base.—Scattered over the mountains at Ladybrand, Orange Free State (Patterson 5134), there is a large-leaved form with fruits as in Dieterlen 17*a* (subglobose, brown, shining, c. 4 mm. in diameter). The petioles are 2–2·5 cm. long. The largest terminal leaflets are 5 cm. by 2·2 cm. broad, the lateral leaflets belonging to them about 3·5 cm. long.

Then there are Dieterlen 17*c* and Phillips 753 (Leribe in Herb. S.A. Mus.). These give one the impression of being coppice shoots; in the latter the leaflets reach a length of 6 cm. The shape of the leaves, especially in Dieterlen 17*c*, varies considerably; some are distinctly acute.

The material of *Rh. fulvescens* Engl. in Herb. Berol. (*Rh. divaricata* var. *fulvescens* Engl. l.c. 429). Diels l.c. 582, collected by Rehmann at Trigaardsfontein, Transvaal, is hardly sufficient to judge whether or not it should be placed with *Rh. divaricata*. The leaflets are paucidentate.

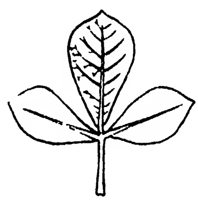
22. **Rh. rupicola** Wood et Evans in Journ. of Bot. 1897, 350.

Rh. Tysoni Phillips in Ann. S. Afr. IX, 119.

? *Rh. colensoana* Engl. in Pflanzenwelt Afrikas III, 2.

Description: Erect, much branched shrub with terete branches, at first tomentose, later often glabrescent. Branchlets short, ascending, terete, tomentose or softly pilose. Leaves petiolate, petioles furrowed above, pilose, usually little more than half the length of the terminal leaflet. Leaflets broadly obovate or obovate-elliptical, at the apex obtuse, subobtuse or slightly emarginate, usually very distinctly plicate-mucronate; at the base cuneate, frequently (especially the terminal ones) subpetiolulate or petiolulate, surfaces more or less softly pilose at first, later more or less glabrous; margin entire, slightly revolute; midrib barely prominent above, strongly prominent below, lateral veins few, unbranched or slightly branched near the margin, delicate above, distinctly prominent below, tertiary veins few, reticulate and very indistinct. Panicles pubescent, axillary (smaller than the leaves) and terminal (longer then the leaves), lax, few flowered with pedicelled flowers and minute subulate bracts. Calyx lobes ovate, subglabrous or pubescent. Petals oblong. Drupe subglobose a little broader than high.

Average length of petioles about 7 mm.; terminal leaflets about 1·3 cm.; lateral leaflets about 1 cm.
Average breadth of terminal leaflets about 8 mm.; lateral leaflets about 5 mm.
Length of axillary panicles about 1 cm.; terminal panicles 2–2·5 cm.
Length of pedicels about 1 mm.; calyx lobes about $\frac{3}{4}$ mm.; petals $1\frac{1}{4}$–$1\frac{1}{2}$ mm.
Diameter of drupe about 4 mm.



Rh. rupicola Wood et Evans. Wood 3932. Under side.

Distribution: Mountains of Griqualand East and Natal at an altitude of 4,500 to 5,500 feet.

In a rocky valley, Liddesdale, Maritzburg county, 4–5,000 feet, Feb. (fl. and fr.), Wood 801, 3932; Malowe forest subreserve, district Umzimkulu, 4,500 feet, Jan. (fl.), Miller D/326 (a small shrub about 2 feet high in grassland, probably dwarfed by grazing and burning, only one plant seen); amongst rocks at Sibiskraal, near Matatiele, Tyson 1268; Zuurbergen, Natal, 5,500 feet, Schlechter 6584. The last two have leaves more hairy than the others on the surface and ciliate on the margin.

Wood and Evans think that this species is allied to *Rh. mucronata*, while Phillips thinks it is allied to *Rh. glauca*. Both of these suggestions are clearly wrong.

LEGATI group.

23. **Rh. Legati** Schonl. nom. nov.

Rh. laevigata Thunb. (in Prodr. 52 and Fl. Cap. ed. Schultes, 264) et auct. plur., non Linn.; E. et Z. in Enum. 1096; Pappe, Sylv. cap. 12; Sonder l.c. 514; Engler l.c. 443; Diels l.c. 589, 639; Sim, Forest Flora 195, t. XLIV.

Rh. acuminata E. Mey. in Herb. Drège; *Rh. crassinervia* Presl Bem. 42.

Description: A shrub or (usually) a tree, often reaching a height of 50 to 80 feet, glabrous or rarely slightly pilose, with reddish, striate branchlets. Stems of young plants and of coppice shoots thorny. Leaves petiolate, petioles slender, furrowed above, variable in length, but often more than three-quarters the length of the terminal leaflets. Leaflets dark green or reddish, firmly membranous, ovate or oblong, acuminate, with a cuneate base which is often, especially in the terminal leaflets, contracted to form a petiolule; surface slightly undulate, margin entire or rarely paucidentate; midrib raised slightly on lower surface, lateral veins delicately curved, slightly raised, tertiary reticulate, immersed. Panicles richly and delicately branched, male chiefly terminal, much exceeding the leaves in length and much longer than the female which are mostly in the axils of the upper leaves; bracts minute, subulate, pedicels very delicate, longer than flowers. Calyx lobes ovate, subacute not quite half the length of the ovate-acute pale green or yellowish petals. Drupe red, shining, subglobose.

Length of petioles 4–7 cm.
Length of terminal leaflets 7–13 cm. Breadth of terminal leaflets 2–4 cm.
Length of lateral leaflets 5·5–10·5 cm. Breadth of lateral leaflets 2·4 cm.
Length of pedicels 2–5 mm.; calyx lobes barely ½ mm.; petals barely 1¼ mm.
Diameter of drupe 4–6 mm. (usually 5 mm.).

Distribution: In the coast districts from the Grootvadersbosch, Swellendam, to Natal, extending somewhat inland even to the northern Transvaal from near sea-level to nearly 6,000 feet. Rarely absent from forests and forest patches, also frequent in stream-bank bush.

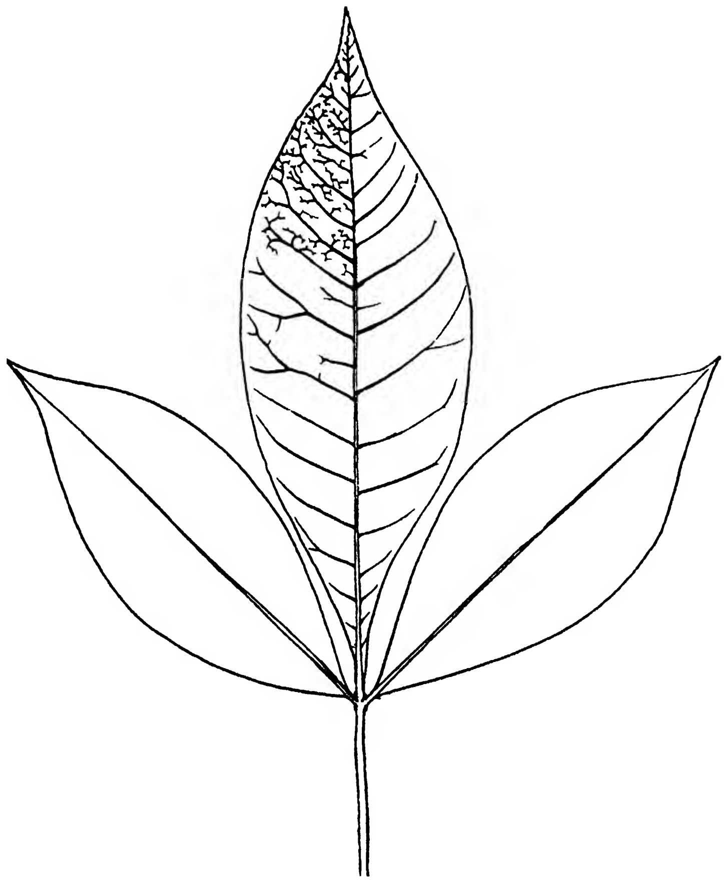
On the edges of forests and in stream-bank bush usually a large bush or small tree with smaller leaves and fruit than when growing in forest, where it always develops into a conspicuous tree.

The tree is known as the "Red Currant tree". It is also known as "Kiriehout" and "Bush Jarrah". In western districts of Cape Colony it is called "Essenhout", the natives of the eastern districts call it "Bosganna".

The wood is red, hard, used by natives for pipes and fancy sticks, sometimes used for yokes and skeys, but not much used by sawyers. Drupe sweetish, when ripe, and eaten by natives, monkeys, and birds. When the stem is cut into or bruised it exudes blood-red sap.

I have felt compelled to give this plant a new name after inspecting Linnaeus' type of *Rh. laevigata* and Thunberg's plant, which he and numerous other authors have called *Rh. laevigata*. The two synonyms could not be adopted either. *Rh. acuminata* E. Mey. must be dropped because there is already a *Rh. acuminata* DC. (=*succedanea* Linn. from Eastern Asia). Nor can I accept *Rh. crassinervia* Presl, because Presl did not characterize his species. Moreover, the name would be most inappropriate. I have taken the liberty to name it after Mr. C. E. Legat, Chief Conservator of Forests, Union of South Africa, under whose direction the Forestry Department has given me much assistance by the supply of material and information.

In view of the fact that the species, within the limits mentioned, has such a universal distribution, I do not, as a rule, quote exact localities of the perfectly glabrous specimens I have examined. Cape Colony: Herb. Thunberg (*Rh. laevigata* Thunb. non Linn.); Burchell 7224, 4485; Drège 3451, 3452, 3568 (*Rh. acuminata* E. Mey.); E. et Z. 1096; Z. 25; Cooper 1548; Jordaan (5106); Duthie 23, 35; Schlechter 5912, 5912*a*; Fourcade 1084; Zahn (5017); Paterson 1985; E. et Z. 314; Paterson 1911*a*; Holland



Rh. Legati Schonl. Paterson 1911*a*. Upper side.

294 (Zuurberg, drupes exceptionally large, about 6 mm. in diameter); MacOwan 294; Britten 1573; Schonland 3143 (2 miles beyond Stone's hill, Grahamstown, leaves exceptionally broad, up to 6·5 cm. and terminal up to 12 cm. long, more leathery than usual); Hoesslin (5126); Staples (4492, 4494, 4495); Dyer 790; Stayner 80; Hunter (5031); Sim 1990; Tyson 2591, 3133; Hilner 144; Schlechter 6176; Flanagan 766; Kolbe and Pegler 3; Van der Merwe (5103); Bennie 392; Dwyer (5114); Tyson 3134; Fegen (5161); Fraser 5036. Natal: ? (5024—Ingwangwane, near Riverside station); Wood 789, 2525; Rudatis 558, 1290; Krauss 124; Gerrard 74, 524; Transvaal (near Vryheid, Waterval Boven, Zoutpansberg, and Pietersburg divisions): Tusten (5056); ? (5006), Rogers 18070, 22034; Pole Evans 16934, 16941.

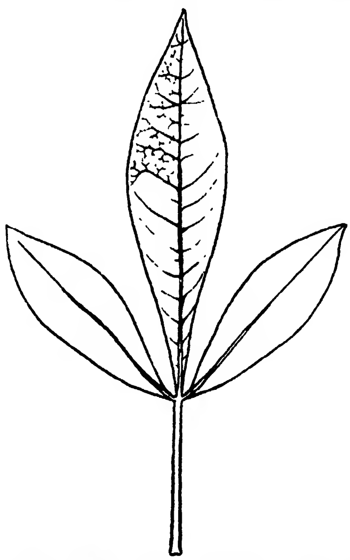
HYBRIDS : Occasionally one finds slightly pilose specimens in the neighbourhood of typically glabrous ones. Whether this is due to hybridization cannot be decided at present. Amongst these are :—

Duthie (25901) in (Herb. S.A. Mus.), Knysna ; Mund (in Herb. S.A. Mus.), Zitzikamma forest ; Tusten (5122), Ngomi forest reserve, P.O. Hlobane, near Vryheid.

On the other hand, where this species occurs with *Rh. dentata*, there are frequently found forms intermediate between them, about the hybrid character of which there can be no reasonable doubt. These are referred to under *Rh. dentata*. Dr. J. Muir (n. 3474) sent me a specimen from Vet River, near Novo, which I look upon as a hybrid between *Rh. Legati* and *Rh. mucronata*. It resembles the former in the nature of the inflorescence, shape and waviness of some leaves. The petioles vary much in length (from less than half to over half the length of the terminal leaflets). The leaflets are more leathery than in *Rh. Legati* and have very distinct reticulate venation. The flowers are larger than in *Rh. Legati* (petals 1½ mm.). Petioles and inflorescences are sparingly hairy and the leaflets also show a few hairs. (See further *Rh. carnosula* Schonl.)

24. **Rh. transvaalensis** Engl. l.c. 440 ; Diels l.c. 638.*

DESCRIPTION : A much branched shrub, generally 3 to 4 feet high, but sometimes reaching a height of 12 to 15 feet. Young branches villous, soon becoming glabrescent. Leaves petiolate, petioles rather slender, half to two-thirds the length of the terminal leaflets, furrowed above, more or less pilose, strongly so on the edges of the furrows. Leaflets subcoriaceous, green, paler on the lower surface, the younger more or less pilose, the older sometimes quite glabrous, oblong-elliptical or oblong-lanceolate, narrowed at the base and apex, acute, mucronulate, margin slightly thickened, often slightly undulate, venation reticulate, not prominent, except the midrib and, to a slight extent, the lateral veins on the lower surface. Panicles numerous, lateral, few-flowered, shorter than leaves, pilose, bracts small subulate, flowers pedicellate. Calyx lobes oblong-obtuse. Petals oblong. Drupe subglobose, shining, pale red or nearly white.



Rh. transvaalensis Engl. (5005). Under side.

Length of petioles one-half to two-thirds of terminal leaflets.
Length of terminal leaflets 2·5–4 cm. Breadth of terminal leaflets 1–1·3 cm.
Length and breadth of lateral leaflets one-half to two-thirds of the terminal.
Length of fruiting pedicels 2–4 mm. ; calyx lobes nearly 1 mm.
Diameter of drupes about 4 mm.

**R. transvaalensis* Engl. should be better placed next to *Rh. pyroides* var. *puberula* and may perhaps even have to be sunk in it. I only recognised this when it was too late to alter the arrangement of the species.

DISTRIBUTION: Common along streams and in scrub-forest on the Drakensberg in the Barberton and Lydenburg districts.

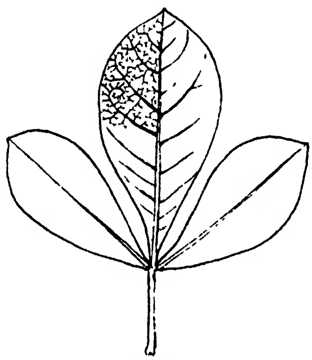
Houtbosch, Rehmann; "Hilltop", Barberton district, Nov., Keet 1456; Halic forest station, Zoutpansberg, Dec., Albany Mus. Herb. 5005 (fr.); Ngomi, 15 miles from Vryheid, 2,000–4,000 feet, Jan., Forester Tusten 5057 (fr.).

25. **Rh. Zeyheri** Sond. l.c. 514; Engler l.c. 433; Diels l.c. 584, 639.
Rh. glauco-virens Engl. l.c. 432; Diels l.c. 584.

Diels states that Engler's species is difficult to separate from *Rh. Zeyheri*. Engler, in his key to the species of *Rhus* in "Pflanzenwelt Afrikas" III, 2, 213, places *Rh. Zeyheri* under *Rh. mucronata* Thunb., while keeping up *Rh. glauco-virens*.

DESCRIPTION: A perfectly glabrous, much branched shrub with slightly angular, often purplish branchlets. Leaves petiolate, petioles rather slender, half to two-thirds the length of the terminal leaflets, slightly furrowed above. Leaflets glaucous green, slightly lighter on the lower surface, sessile or the terminal petiolulate, obovate or obovate-oblong, cuneate at the base, obtuse, acute or apiculate, often mucronulate; margin entire or rarely paucidentate, flat; midrib somewhat prominent on both surfaces, lateral veins slightly prominent on both surfaces, tertiary veins reticulate, immersed. Panicles laxly flowered, axillary shorter than the leaves, terminal somewhat longer, bracts subulate, flowers pedicellate. Calyx lobes ovate, obtuse. Petals oblong, yellowish. Drupe fleshy, brown, shining, subglobose.

Length of petioles 1–1·5 cm.
Length of terminal leaflets 2–3 cm. (rarely up to 6 cm.). Breadth of terminal leaflets about 1·7 cm.
Lateral leaflets barely two-thirds the size of the terminal leaflets.
Length of calyx lobes about ¾ mm. (variable in size in the same flower sometimes).
Length of petals about 1¼–1½ mm. Diameter of drupe 5–5·5 mm.



Rh. Zeyheri Sond. Rehmann 4740. Under side.

DISTRIBUTION: On edge of streams and on kopjes near Pretoria, varying considerably according to habitat. Also recorded from the Drakensberg.

Z. 345 (Herb. Kew: type of *Rh. Zeyheri* Sond.); Rehmann 4740 (type of *Rh. glauco-virens* Engl.) Burtt-Davy 291, 2532, 2691; McLea in Herb. Bolus 5618; Leendertz 83, 324, Verdoorn 8, Schlecht 3626, Sturdy 4266.

At Groenkloof, near Pretoria, a form with deep-green leaves occurs (Howlett 5 and 5a). It cannot be separated by any other character from the type. Some of Pole Evans's specimens from Irene were named by Burtt-Davy *Rh. puberula* var. *Zeyheriana*.

LUCIDA group.

26. **Rh. lucida** L.Sp. Pl. 382; *Rh. lucida β* Ait. hort. Kew, ed. 2, 11, 266; Comm. hort. 1, t. 93; Thunb. Fl. Cap., ed. Schultes 264; Jacq. hort. Schoenbr. t. 347; Engler l.c. 413; Diels l.c. 574, 632, fig. 7 A, B (p. 634); *Rh. Cavanillesii* DC. Prodr. II, 69; *Rh. outeniquensis* Scz.; *Rh. scoparia* E. & Z.

Rh. lucida L., is, in eighteenth century collections, often mixed up with *Rh. glauca.* However, this has usually obcordate thinner leaflets with lateral veins placed close together, etc. There is a scrap (without flowers) in the Plukenet Collection, British Museum, named *Rh. lucidum* Mill. Pluk. t. 219, fig. 9, which appears to be typical *Rh. lucida* L. Amongst typical specimens of *Rh. lucida* which are found in many herbaria, E. & Z. 1113, from the Lion's Head, Capetown, and MacOwan 1827 in Herb. Austr. Afr. from Constantia may be mentioned. Such typical specimens can easily be distinguished from typical *Rh. scoparia* E. et Z., but, having examined a large amount of material, I am unable to separate the latter sharply from *Rh. lucida.* Already Diels (l.c. 575) has, contrary to Sonder, stated that the characters of *Rh. scoparia* : "short petioles, smaller leaves, longer downy panicles" have no systematic value, though I have long hesitated to unite these two species, since *Rh. Schlechteri* might then also have to come into *Rh. lucida.*

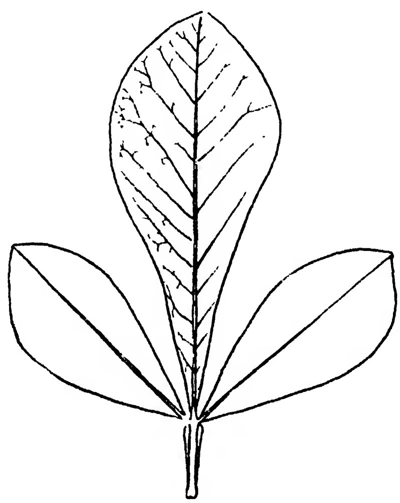
The varieties established by Sonder l.c. 517 cannot be kept up. I divide *Rh. lucida* into three varieties :—

A. *typica*, B. *outeniquensis* (*Rh. outeniquensis* Szysz.), and C. *scoparia* (*Rh. scoparia* E. et Z.).

The wood is used for fencing posts and spokes in the Knysna division.

Description : A much branched shrub, often over 10 feet high, with pulverulent-puberulous or shortly downy branchlets, sometimes covered with resinous excretion. Leaves petioled, petioles of variable length, slightly winged and canaliculate above. Leaflets often glossy, subcoriaceous, obovate-oblong, cuneate at the base, quite blunt or subacuminate, rarely emarginate or coarsely crenate at the apex. Midrib slightly prominent, lateral veins delicate but distinct, tertiary veins usually not visible. Panicles lateral and terminal, shorter or slightly longer than the leaves, puberulous or covered with resin, lax. Flowers sometimes hermaphrodite, shortly pedicelled. Calyx lobes subtriangular-ovate, often puberulous. Petals oblong, about three times the length of the calyx lobes. Drupe brown, shining, subglobose.

Length of petioles from 1 mm. to 3·5 cm. (see varieties).
Length of terminal leaflets $1\frac{1}{2}$-7 cm. Breadth of leaflets 5 mm. to $2\frac{1}{2}$ cm.
Lateral leaflets about two-thirds the size of the terminal leaflets.
Length of pedicels 1-2 mm. ; calyx lobes about $\frac{1}{2}$ mm. ; petals $1\frac{1}{4}$-$1\frac{1}{2}$ mm.
Diameter of drupe 3-5 mm.



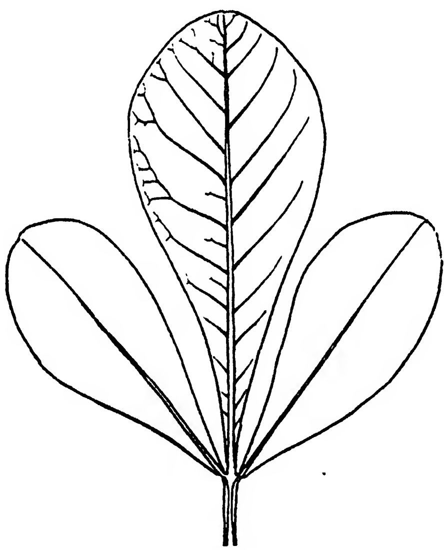
***Rh. lucida* L., A. *typica* E. et Z. 1113.** Under side.

DISTRIBUTION : On edges of scrub and forests and isolated on mountain slopes in the coast districts from the neighbourhood of Capetown to Natal (also found in Gazaland at an altitude of 7,000 feet: Swynnerton M 635).

A. *typica.*—Petioles usually 5–6 mm. long. Terminal leaflets usually about 3½–4 cm. long (except in coppice shoots, in which they may exceed 6 cm. in length). Drupe (as far as known) c. 3½ mm. in diameter.

Common on hillsides near Capetown, e.g. E. et Z. 35, 113, Wolley Dod 2029, Schlechter 1333, Drège 6791 (var. *subdentata* DC.), 6802, MacOwan in Herb. Austr. Afr. 1827, Rogers 11242, Lichtenstein 193, Wilms 3123, Engler 52, 55 ; in dunes at the mouth of the Onrust River, Z. 2235, 2248 (var. *elliptica* Sond.) ; hills near Paarl, 300 feet, Schlechter 9208 ; edge of bank of Knysna River, Schonland 3430 ; northern slopes of Knysna Heads, 50–200 feet, Schonland 3378 ; Humansdorp division, Rogers 28266 ; ridges near Groendal, Zwartkops River valley, common, J. Sim 227 ; Springfields, near Uitenhage, J. Sim 129 ; Port Alfred, Rogers 28036 (leaflets more decidedly narrowed in lower part than usual, many crenato-dentate at apex) ; Blaauwkrantz, Hilner 63 ; common on the hills south of Grahamstown, e.g. Britten 1608, 1522, 1593, 1594, 2179, Schonland 1892 (very near *Rh. scoparia* E. & Z.), 82 (not distinguishable from Capetown specimens) ; Aylesby, near Riebeek East, Schonland ; margins of lower forest, Hogsback, Rattray 357 ; Fort Cunynghame, Sim 2185 ; Ntsubane, near Lusikisiki, Fraser (5137, 5144) ; Bushmans River valley, Natal, Wood 10635 ; Friedenau, Umgaye flats, Alexandra county, c. 700 m., Rudatis 115, 1130.

B. *outeniquensis* (*Rh. outeniquensis* Scz. in Polypetalae Disciflorae Rehmannianae, Cracoviae 1888, 52).—Branchlets more slender than usual, leaves larger than in A, drupe larger. Petiole generally about 1 cm. long, terminal leaflets generally 5–7 cm. long, drupe (as far as known) 3½–5 mm. in diameter.

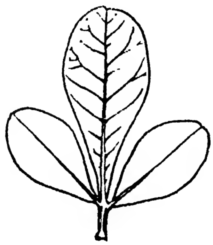


Rh. lucida L., B. *outeniquensis*. Fourcade 8. Under side.

Montagu Pass, Rehmann 272 in Herb. Berol. ; Piquetberg, 1,000–1,500 feet, Schlechter 5199; Kl. Kruis R., Muir 3475 ; Muiskraal, Garcias Pass, 1,000 feet, Galpin 3895 ; Gr. Brak R., 30 feet, Schlechter 5737 ; Rust en Vrede, Oudtshoorn, 3,000 feet, Dyer 85 ; Uniondale, Paterson 3019 ; Knysna heads, Williamson 29 ; Sourflats, Knysna, Keet 447, 612, 614, 615 ; Gully, north-east of Royal Hotel, Knysna, Schonland 3494 ; Knysna, Marloth 7917 (petioles up to 2·5 cm. long) ; Blaauwkrantz forest reserve, Zahn (5014, 5027, 5028 (petioles in 5027 up to 3 cm. long) ; margin of coast forest, Ratelsbosch, 600 feet, Fourcade 8 (petioles up to 1½ cm. long) ; Van Stadens, Paterson 736.

Perhaps Schlechter 6754 collected at Van Reenen belongs here also. The petioles here reach a length of 3·5 cm.

C. *scoparia* (*Rh. scoparia* E. et Z. in Enum. 1122, Sonder l.c. 518, Engler l.c. 415; Diels l.c. 575, 632).—Petioles 1–4 mm. long. Terminal leaflets generally $1\frac{1}{2}$–$2\frac{1}{2}$ cm. long. Drupe (as far as known) about 3 mm. in diameter.



Rh. lucida L. (close to var. C. *scoparia*). Schonland 1892. Upper side.

Olifantshoek, Alexandria division, E. & Z. 1122; Nieuweveldberge, Drège 6803; Knysna commonage, not common, 600 feet, Keet 660; Humansdorp, under 500 feet, Rogers 2908; Longvale, P.O. de Kol, Alexandria division, common, Gant 47; Springfields, Uitenhage, J. Sim 129; road from Port Alfred to Three Sisters, Britten 720; hills south of Grahamstown, Schonland 615, Britten 1594, 2804.

The following comparative notes on the structure of the leaves taken from Diels l.c. 575 are of interest:—

Rh. lucida L.	*Rh. scoparia* E. et Z.	*Rh. Schlechteri* Diels.
Hairs—	Hairs—	Hairs—
Glandular scales on both surfaces (Pl. XIV O)	Numerous glandular scales on both surfaces.	Glands especially active when young.
Epidermis—	Epidermis—	Epidermis—
Lumen, 10–15 μ.	Lumen, 10–15 μ.	Lumen, 15–20 μ.
Wall, 3–5 μ.	Wall, 5–7 μ.	Wall, 6–12 μ.
Ground tissue—	Ground tissue—	Ground tissue—
Only the outer layer palisade like.	Loosely palisade like.	Loosely palisade like.
Stomata—	Stomata—	Stomata—
Only on lower surface, slightly raised.	Many on lower surface, slightly raised.	On lower surface, numerous, not raised.

These notes confirm, as far as they go, the general impression one gains in handling these species: that they form a series towards more and more decided xerophytism, and it is a great pity that cultural data are hitherto absent to decide in how far their characters have become fixed or not.

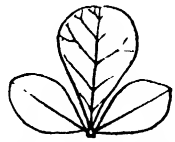
HYBRIDIZATION: Occasionally one finds forms which lead to the conclusion that hybrids with *Rh. glauca* Thunb. and allied species occur. The var. *elliptica* Sond. (e.g. Z. 2248 from downs near Onrust River) seems to be composed of such hybrids.

27. **Rhus Schlechteri** Diels in Engl. Bot. Jahrb. XXIV (1898), 501; ib., 575, 634, fig. 7 E.

This species is very close to *Rh. lucida* var. *scoparia*. The practically sessile and relatively broader leaves distinguish it from this species. Diels describes it from Schlechter's specimens, collected at Elim, which are without flowers and fruits.

DESCRIPTION: A much branched shrub up to 10 feet in height with short, densely leafy, slightly angular branchlets, which are pubescent when young and become glabrous later. Leaves sessile. Leaflets subcoriaceous, often with a resinous secretion which may, on drying, form a thin greyish crust, obovate or obcordate-cuneate, at the apex obtuse, subtruncate or slightly emarginate; margin entire; midrib slightly raised, lateral veins immersed or slightly raised, tertiary veins rarely visible. Panicles lateral and terminal slightly longer (or female shorter) than the leaves, laxly flowered. Flowers pedicellate. Sepals ovate, obtuse. Petals oblong. Drupe globose, shining.

Length of terminal leaflets 8–14 mm. Breadth of terminal leaflets 5–10 mm.
Lateral leaflets about two-thirds the size of terminal ones.
Length of pedicels about 1½ mm.; calyx lobes ½ mm.; petals about 1½ mm.
Diameter of drupe (in J. Sim 78) 4 mm.



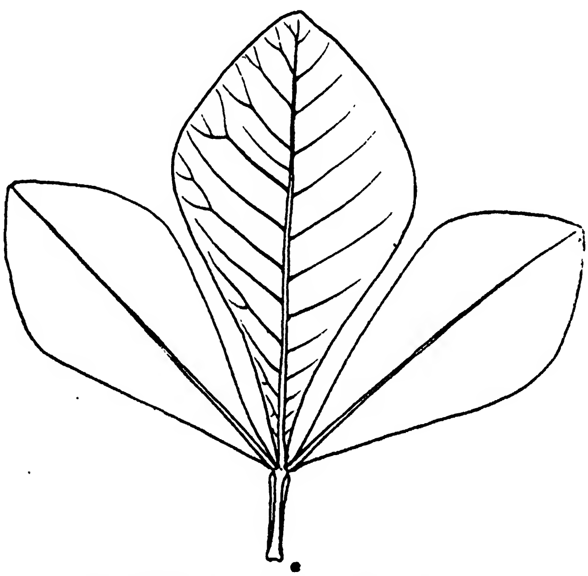
Rh. Schlechteri Diels. Burchell 4522. Under side.

DISTRIBUTION: Chiefly on fixed sand-dunes from Bredasdorp division to the neighbourhood of Port Alfred, often gregarious and dense.

On rocky places near Elim, Bredasdorp division, about 150 m., Schlechter 7624 in Herb. Berlin; Burchell 4522 (quoted by Engler both under *Rh. glauca* and *Rh. scoparia*); Buffalo Bay, Knysna; Duineveld, between the Kromme and Zitzikamma R., J. Sim 78; near Schoenmaakers Kop, Port Elizabeth, J. Sim 27; Walmer, Paterson 826; Humewood, Daly 1051; frequent near the Kasouga and Port Alfred, Britten 2108, 2295, 5015.

28. **Rh. africana** Mill. dict. n. 11; Sonder l.c. 517 p. pte; Engler l.c. 414 p. pte; Diels l.c. 574, 632 p. pte; *Rh. mucronata* E. et Z. in Enum. 1129 (non Thunb.).

A curious mistake has been made in connection with this species. Under Ecklon 37 two different species have been distributed, one from Witsenberg, Tulbagh, is *Rh. cuneifolia* Thunb., the other (= E. et Z. 1129) is closely allied to *Rh. lucida*, with which it agrees in many characters, especially in the nature of the drupe, which is not described by Sonder in Fl. Cap. I, 517. Unfortunately, however, Plukenet's specimens in the British Museum leave a little doubt as to what is really meant by *Rhus africana*. There are two branches bearing this name which undoubtedly belong to two different species. The lower (without flowers and fruit) may be the plant which Sonder took to be his var. *macrophylla* of *Rh. africana* Mill. Next to it is a printed label bearing the words "type specimen", and I have, therefore, taken it as the type.



Rh. africana Mill. E. et Z. 1129. Upper side.

DESCRIPTION : A low much branched shrub with densely pubescent branchlets. Leaves shortly petiolate, petioles at first pubescent, later often glabrous, short, canaliculate above, winged. Leaflets coriaceous, glabrescent or glabrous, sessile, obovate-cuneate, or oblong-cuneate, subobtuse, shortly plicato-mucronulate, margin slightly revolute, usually entire; midrib and lateral veins raised on both surfaces, especially on the lower, tertiary veins not visible. Panicles axillary, puberulous, shorter or slightly longer than the leaves, pedicels very short. Calyx lobes ovate, petals oblong. Drupe as in *Rh. lucida.*

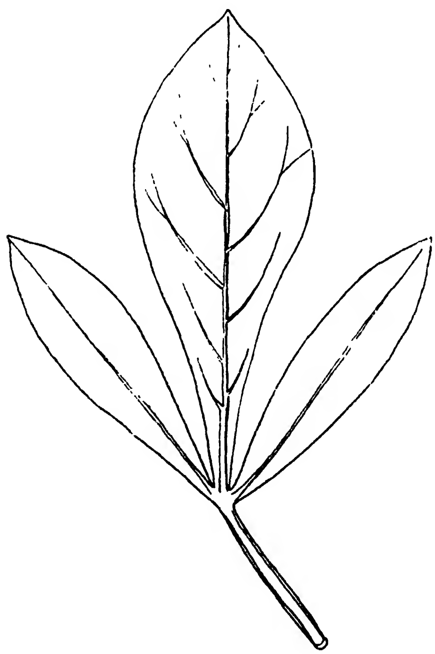
Length of petioles 8 mm. to 2·1 cm.; terminal leaflets 4–6 cm. (rarely longer).
Breadth of terminal leaflets 2–3 cm.
Lateral leaflets about two-thirds the size of the terminal leaflets (or smaller).
Length of calyx lobes 1 mm.; petals 2 mm.
Diameter of drupes about 4 mm.

DISTRIBUTION : From the Tulbagh division through Clanwilliam to the Van Rhynsdorp division (also in the Hex River Mts.?), flowering in June, July, August.

Rocky places, Vogel Vley, 1,500 feet, Schlechter 7529; amongst heaths (alt. V), mountain sides near Brakfontein, Clanwilliam, E. & Z. 1129; summit of Heerelogement, Z. In specimens at Kew, collected at Els Kloof, Hex River, Wolley Dod 4044, the leaflets are crenato-dentate in the upper portion.

29. **Rh. albomarginata** Sond. l.c. 519, Engler l.c. 413, Diels 574, 632.

This species is allied to *Rh. lucida* (not *excisa* as Sonder said). It has large flowers. It is, as far as I know, not represented in any South African herbarium, and, although I know the places where it was found fairly well, I have never seen it growing.



Rh. albomarginata Sond. Burke in Herb., Kew.

DESCRIPTION : A glabrous shrub with angular compressed branchlets. Leaves petioled, petioles nearly half the length of the terminal leaflets, canaliculate above and margined. Leaflets slightly undulate, coriaceous, obovate-oblong-cuneate or the terminal subrhomboid

in the upper part passing into a narrow cuneate base, lateral oblong-cuneate, blunt or slightly acuminate, entire with thickened, white, slightly revolute margin; midrib comparatively broad in lower half, slightly prominent below, lateral veins slightly prominent below, slightly branched towards the margin. Panicles axillary, shorter than the leaves. Calyx lobes ovate, petals oblong-ovate. Drupe ?

Length of petioles 1·5–2·5 cm.
Length of terminal leaflets 3–4 cm. Breadth of terminal leaflets 1–1·5 cm.
Lateral leaflets about two-thirds the length of terminal leaflets.
Calyx lobes about 1 mm. long (teste Engler). Petals about 2 mm. long (teste Engler).

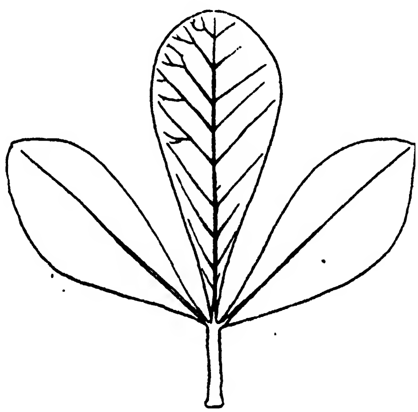
Distribution: Only collected in the neighbourhood of Grahamstown, where, however, it must be very rare.

Herb. Kew: Slaay Kraal, Burke; Sidbury, 1,000 feet, MacOwan 749.

30. **Rh. scytophylla** E. et Z. in Enum. 1130; Sonder l.c. 517, Engler l.c. 412, Diels l.c. 574, 637, fig. 8 D.

Description: A shrub reaching a height of 6 feet with glabrous or puberulous branchlets. Leaves shortly petioled, petioles broadly margined. Leaflets coriaceous, sessile, obovate-oblong-cuneate, blunt or emarginate, sometimes mucronulate, usually entire, with slightly revolute margin, sometimes shining; midrib slightly prominent on the upper side, more so on the lower, lateral veins usually slightly prominent on both surfaces, sparingly branched in the upper part of the leaflets near the margin, tertiary veins not visible. Panicles multiflowered, lateral and terminal, puberulous, longer than the leaves, flowers pedicelled. Calyx lobes ovate, glabrous or minutely puberulous. Petals oblong. Drupe globose (teste Sonder "as in *Rh. lucida*").

Length of petioles usually 5 mm., but may reach 1·5 cm.
Length of terminal leaflets 2·5–4 cm. Breadth of terminal leaflets 1–1·5 cm.
Lateral leaflets about two-thirds the size of the terminal ones.
Length of pedicels 2–3 mm.; calyx-lobes about ½ mm.; petals about 1¼ mm.



Rh. scytophylla E. et Z. Z. 2247. Under side.

Distribution: On the mountains near Tulbagh, Stellenbosch, Caledon, and Swellendam, flowering from April to July.

Grietjesgat, near Palmiet R., E. & Z. 1130; Hottentots Holland, Z. 2247; Witzenberg, Pappe; Howhoek, 1,500 feet, Schlechter 7767, and the following in Herb. Kew: Z. 2246, Drège 6807*b*, Burchell 7835, 8662, 8033 (in the last many leaves are crenate-dentate at the apex).

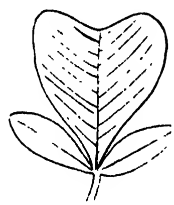
31. **Rh. glauca** Desf. arb. II, 326; Thunb., Fl. Cap. ed. Schultes, 265; Sonder l.c. 516; Engler l.c. 411; Diels l.c. 573, 635; Marloth, Das Kapland 526.

Rh. Thunbergiana Roem. et Schult. Syst. Veg. VI, 657; *Rh. lucida* E. Mey. in Drège exsicc. (non Linn.).

DESCRIPTION: An unarmed glabrous shrub with subangulate branches more or less covered with resin, which eventually dries and becomes grey. Leaves petioled, resinous or, when the resin dries in summer, covered with a grey powder, petioles canaliculate above, slightly winged. Leaflets sessile, terminal usually obcordate-cuneate, lateral obovate or obcordate, sometimes plicate-mucronulate; midrib and lateral veins (which are often minutely wavy) slightly raised above and below, tertiary veins not visible. Panicles terminal and lateral much branched, two to three times longer than the leaves, flowers pedicelled. Calyx lobes ovate. Petals oblong. Drupe globose, shining, reddish.

Length of petioles 8–12 mm.
Length of terminal leaflets 1·5–2 cm. Breadth of terminal leaflets 1–1·2 cm.
Lateral leaflets about two-thirds the size of the terminal ones (sometimes less).
Length of pedicels 1–2 mm.; calyx lobes ½ mm.; petals 1½ mm.
Diameter of drupe about 5 mm.

Sometimes the number of leaflets in some leaves is reduced to one or two, sometimes increased to four.



Rh. glauca Desf. Herb. Thunberg.

DISTRIBUTION: On mountains and hills in south-west Cape Colony and on sand-dunes, extending eastwards to Grahamstown, Queenstown, and East London,* flowering generally in winter and fruiting about September.

Herb. Thunberg; Burchell 378; Piquetberg 400 feet, Schlechter 7895; Darling, Malmesbury division, Bachmann 377; Cape Peninsula, E. et Z. 1120 (*Rh. Thunbergiana* Roem. et Schult. ex E. et Z. Enum.), E. et Z. 1121, Wilms 3124, Diels 2, 1273, Drège 116*d*, E. & Z. 34, Engler 114, Schlechter 1007; Caledon, E. & Z.; Genadendal, 800 feet, Schlechter 10331, 10332 (leaflets more elongate than usual); Knysna heads, Keet 1029, Schonland 3528; Belvidere, Knysna, Duthie 663; the Glebe, Knysna, Phillips 159; Duineveld, between Slang and Kromme R., 6–8 feet, common sand-stay, J. Sim 9, Phillips 1610; coastal and dune area near Schoenmakerskop, Port Elizabeth, J. Sim 23; Humewood, Paterson 3362; Grahamstown, near Golf Links, Gane 15, Bowker's Park, near Queenstown, Hilner 313. Drège 116*b*, which belongs here, was marked at Kew "*Rh. lancea* Desf. ex Presl Bem. 41."

Z. 2241 (evidently = E. et Z. 1120) was named *Rh. Thunbergiana* R. et S. and *Rh. plicaefolia* Z., but is not *Rh. plicaefolia* E. et Z. 1118.

Specimens collected by Dr. Meyer in 1869 in the Hantam mountains are marked "forma ad excisam spectans". I doubt whether they belong here.

Specimens of Sieber, Fl. Cap. 218, in the Berlin Herbarium, marked "*typus Rh. glauca* (*Rh. Thunbergiana* R. et Sch.)", have mostly obtuse, obovate, cuneate leaflets.

* This may have to be modified as in the absence of fruits of many of the specimens examined I am unable in some cases to say for certain whether they belong to *Rh. glauca* Desf. or *Rh. undulata* Jacq. Those from inland localities especially are doubtful. In old collections *Rh. glauca* is often named *Rh. lucida* L.

32. **Rh. undulata** Jacq. in Hort. Schoenbr. t. 346 ; Sonder l.c. 518 ; Engler l.c. 410 ; Diels l.c. 573, 594, 632.

Rh. excisa Thunb., Fl. Cap. ed. Schultes 264 ; Drège exsicc. ; E. et Z. 1125.
Rh. nervosa E. et Z. (non Poir.) in Enum. 1115.
Rh. pallens E. et Z. in Enum. 1114.
Rh. plicaefolia E. et Z. in Enum. 1118.
Rh. spathulata E. et Z. in Enum. 1119.
Rh. aglaeophylla E. et Z. in Enum. 1117.
Rh. micrantha E. et Z. in Enum. 1124 (non Thunb.).
Rh. mucronata E. Mey. in Drège exsicc. (non Thunb.).
Rh. celastroides Sond. l.c. 519 ; Engl. l.c. 417 ; Diels l.c. 576, 628.
Rh. Burchellii Sond. in Engl. l.c. 412 ; Diels 574, 633, fig. 7 G.
Rh. Rangeana Engl. in Pflanzenwelt Afrikas III, II, 205, fig. 101 A–E.
Rh. vernicata Schlecht. ib. 205.
Rh. Galpinii Engl. (non Schinz) ib. 208.

DESCRIPTION : A very variable, usually unarmed shrub, glabrous except young leaves, which may be puberulous, often reaching a height of 15 feet in the coast districts, and then main branches reaching a thickness of 8–9 inches. Branchlets slightly angular. Leaves petiolate, petioles winged, particularly in the upper part. Leaflets often covered with a resinous excretion, membranous or (in the arid parts of South Africa) subcoriaceous or coriaceous, cuneate-oblong, obovate-oblong, obtuse, acute or emarginate, often plicate-mucronulate, margin entire or rarely irregularly dentate or rarely crenate ; midrib slightly prominent on both surfaces, lateral veins delicate but distinct, tertiary veins not visible. Panicles lax, axillary usually shorter than the leaves, terminal somewhat longer. Calyx segments ovate. Petals oblong. Drupe glabrous, compressed, often remaining green when ripe.

Length of petioles 1·2–2·2 cm. (in var. *celastroides* and *Burchellii* smaller).
Length of terminal leaflets 3–5·5 cm. (in var *celastroides* and *Burchellii* smaller).
Breadth of terminal leaflets usually 1–1·3 cm. (in var. *celastroides* and *Burchellii* smaller).
Lateral leaflets one-half to two-thirds of terminal leaflets.
Length of calyx lobes about ½ mm. ; petals 1¼–1½ mm.
Greatest diameter of fruit about 3 mm.

1. *Rh. undulata* Jacq. Herb. Jacquin.
2. *Rh. undulata* Jacq. Herb. Jacquin (teeth of obovate leaflet enlarged).
3. *Rh. undulata* Jacq., var. *Burchellii* Schonl. Burchell 1722.
4. *Rh. excisum* Thunb. Herb. Thunberg (very close to *Rh. undulata* Jacq. var. *celastroides* Schonl.).

DISTRIBUTION: In the coast districts from Damaraland to Natal and in the dry interior of the Cape Province, southern Bechuanaland, Orange Free State, and the Transvaal, having adapted itself to a wide range of climatic conditions. It flowers mainly in the late summer and autumn.

Rh. undulata Jacq. is represented in Herb. Jacq. at Vienna (but without flowers and fruits). The leaves vary in size and shape. The terminal leaflet may be from 4–6½ cm. in length. The leaflets in the type specimens are obovate, oblanceolate, obtuse or subacute. Their margins are slightly undulate or in some leaflets irregularly dentate. Some leaves are indistinguishable from *Rh. excisa* Thunb., with the type of which I have compared them (*Rh. excisum* fol. β in Herb. Thunberg, Upsala). Sonder (l.c. 519) says that it differs from the preceding by the three times smaller, not undulate or incised-toothed leaflets. Already Engler (l.c. 411) had stated with reference to *Rh. excisa*: " Valde affinis *Rh. undulatae* et vix nisi foliis paullo crassioribus supra haud resinosis integris diversa ". Diels (l.c. 573) states that these distinctions do not hold good, and I agree.

Thus *Rh. excisa* Thunb. is best sunk in *Rh. undulata* Jacq. Both have compressed fruits which distinguish them from *Rh. glauca* Thunb.; their leaves, however, sometimes approach the latter in shape, texture, and size. Typical *Rh. undulata* (incl. *Rh. excisa*) occurs in the southern coast districts of South Africa. Already in these the leaflets may retain on their surfaces a copious supply of resin. This is often more decided in the more arid interior parts. At the same time the leaves become smaller in size. There is a bewildering number of forms; the most decided ones are those which have been placed by various authors under *Rh. celastroides* Sond. (l.c. 519) and *Rh. Burchellii* Sond. (in Engl. l.c. 412). Extreme forms of these are easily distinguished, but I have failed to separate them satisfactorily when large series of specimens were examined. I, therefore, place them as varieties under *Rh. undulata*. A number of other forms described without sufficient reason as separate species will be mentioned presently.

A. *genuina*.—Leaflets membranous, terminal usually about 3–5 cm. long.

α forma *undulata*.—Leaflets not conspicuously resinous, obovate-oblong or obovate, cuneate at the base, apex obtuse or acute rarely deeply emarginate, margin entire, undulate, undulate-denticulate, dentate or rarely crenate.

β forma *excisa*.—Leaflets not conspicuously resinous, entire or emarginate at the apex, narrowly obovate-oblong or obovate-lanceolate, often plicate-mucronulate.

γ forma *contracta*.—Leaflets similar to β, but very resinous. Lateral branches often contracted, sometimes turning into thorns (*Rh. vernicata* Schlecht.).

B. *celastroides* (*Rh. celastroides* Sond.).—Leaflets subcoriaceous, usually conspicuously resinous, smaller than in var. A, generally very acute. Plants of squarrose habit, often thorny. (In the type, Z. 233, the leaflets are mostly lanceolate, acuminate, undulate, but some are oblanceolate, obtuse, with or without a mucro. There are no tangible floral or fruit characters that can be used to distinguish it from var. A). Only found in arid parts.

C. *Burchellii* (*Rh. Burchellii* Sond., *Rh. Rangeana* Engl.).—Leaflets coriaceous, shining, rarely slightly exceeding 1 cm. in length, often much smaller, obcordate-cuneate, much contracted in the lower half, entire or rarely more or less crenate near the apex. Plants sometimes thorny. Only found in arid parts.

A. *genuina* α *undulata*.

Herb. Jacquin, Vienna; Drège 5889; Piquetberg, Diels 190; Olifants River valley, west of Clanwilliam, Diels 1149; ib., on sandhills, Diels 228; Van Rhynsdorp, about 1,000 feet, Diels 558; Darling, Gürke 609; Saron, Schlechter 7782 (in the two last, as in some others, the leaflets are obovate and bluntly crenate in the upper part); Calvinia, Rijsjoen mountain, Marloth 10300; Heerelogement, E. & Z. 338; expedition to the Khamiesberg, Giftberg, and Olifants River, 1–2,000 feet, Phillips 7528; amongst shrubs east side of Table Mountain, near Constantia, E. & Z. 39, 1124 (*Rh. micrantha* E. et Z. non Thunb.); mountains above Worcester, Rehmann 2517 (with larger leaves than usual, probably a coppice shoot);

Worcester, hills opposite station, Marloth 9952 ; Robertson, base of foothills, De Hoop Road, Britten 653 ; Phisantefontein, Kl. Karroo, Muir 2477 ; hills south of Matjesfontein, Pearson 2967, Rehmann 2912 ; Prince Albert, Marloth 11277 ; near Laingsburg, Marloth 3972 ; Ceres, Karroo, Marloth 10472 ; slopes of Bokkeveld, 400 m., Marloth 7796 ; Wupperthal, Marloth 7502 ; hills near Genadendal, Schlechter 10331 ; Groot River Hill West, Zitzikamma, Fourcade 1238 ; Cango Kopje (Oudtshoorn), near hotel, frequent, Britten 1730 ; Baakens River valley, Port Elizabeth, J. L. Drège 533 ; Port Elizabeth, James 3 ; Natal, Wood 9340. Cultivated specimens ex hort. Paris 1823, in the Berlin Herb., agree well with Jacquin's types as well as some of Diels' specimens.

The following has small entire leaflets and relatively long petioles which are broadly winged (the broadness of the wings, however, varies in Jacquin's types). The average length of the petioles is 1·2 cm. of the terminal leaflets 1·3 cm. The leaflets are broadly oblanceolate, obtuse, rarely emarginate : Klipfontein, Namaqualand, c. 3,100 feet, Bolus 9504. Some specimens of Sieber, Fl. Cap. 154, agree closely with this.

A. *genuina β excisa.*

Herb. Thunberg ; Nieuwe Hantam, Drège 6408*b* and 6809 p. pte. ; Drège 5589 ; Calvinia, common on south-east slope of the Roupmyniet, 900–1,000 feet, Diels 666 ; Tulbagh, Worcester, and Clanwilliam, E. et Z. 1125 ; rocky places near Ladismith, Marloth 2989 ; hills near Mossel Bay, Schlechter 5725 ; Glebe, Knysna, Phillips 15 ; Knysna heads, Keet 1029, Schonland 3528 ; Belvidere, Knysna, Duthie 663 ; Plettenberg Bay, 10 feet, Schlechter 5932 (terminal leaflets only 1·5–2 cm. long) ; Hankey, Paterson 20 ; karroid places between the Zwartkops and Sundays Rivers, Z. 2243, E. & Z. 1118 (*Rh. plicaefolia* E. et Z., *Rh. excisa γ emarginata* Sond.—E. & Z. remark : " Folia valde variant ") ; Uitenhage and Addo, 50–500 feet, E. & Z. 1115 (*Rh. nervosa* E. et Z. non Poir.—has slightly thicker leaflets than the preceding ones. The growth is more fastigiate) ; Earncliff, Port Elizabeth, 100 feet, Galpin 6378 (this agrees well with *Rh. nervosa* E. et Z. ; such forms closely approach var. *celastroides*) ; amongst shrubs on the Zwartkops River, E. & Z. 1119 (*Rh. spathulata* E. et Z.) ; Zwartkops River and Addo, E. & Z. 39, 1114 (*Rh. pallens* E. et Z., *Rh. excisa β pallens* Sond.) ; in scrub near Uitenhage, Schlechter 2521 ; along the Bushmans River, Alicedale, Schlechter 2706 ; Bothas Hill, Grahamstown, E. & Z. 39, 1117 (*Rh. aglaeophylla* E. et Z.) ; very common in open bush (except in karroid places) on the Zuurberg range, Grahamstown, e.g. E. & Z. 406, Britten 1503, 1524, 1533, 1555, 1571, 2739, Gane 66, 325, MacOwan 504, Rogers 27711, Dyer 59, 60 ; Bathurst, Nell (5157) ; Kowie West, Britten 5016 ; Bedford, Nicol 78 ; Katberg, about 4,000 feet, Staples (5022*a*) ; Wolfridge, Amatolas, Hunter ; Keiskama hoek, Dawson (5073) ; Kingwilliamstown, Schlechter 6128 ; Windvogelberg, near Cathcart, 3,500 feet, Baur 1119 ; Queenstown, 6,000 feet, Galpin 2142 (*Rh. Galpinii* Engl. non Schinz, approaches *Rh. glauca* in the shape of the leaflets) ; East London, Gane 312 ; Komgha, Flanagan 320, 799 ; Bazija, Transkei, Baur.

A. *genuina γ* contracta.

Hills at I'Us (Western Region), Schlechter 11434 ; Queenstown, Rogers ; in bush near Kingwilliamstown, 1,500 feet, Tyson 2100 ; near the Kabousie River, Komgha, 2,000 feet, Flanagan 701.

B. *celastroides—Rh. celastroides* Sond.

Namos, Bechuanaland, Z. 233 ; Karreebergen, Schlechter 8196 ; Little and Great Namaqualand, Pearson 5728, 3946, 3418, 3341, 3964, 4960, 3761, 2978, 4220.

C. *Burchellii—Rh. Burchellii* Sond., *Rh. Rangeana* Engl.

At the confluence of the Vaal and Orange Rivers, Burchell 1722 ; Basutoland, Cooper 2172 ; Leribe, 5–6,000 feet, Dieterlen 581 ; Bloemfontein, Rehmann 3800, 3887 ; Elandshoek, near Aliwal North, Bolus 10487 ; near Burghersdorp, Flanagan 1532 ; Conway farm, Galpin 5516 ; Honey Nest Kloof, Wilman 1522; mountain ravines near Murraysburg, Tyson 296 ; on rocks amongst hills, Leeuwfontein, 2,600 feet, Pearson 3228 ; common in Namaqualand and the South-West Protectorate, e.g. Pearson 3801, 5728, 8203, 3174, Dinter 1134, 1134*a*, Schäfer 168, 236, Engler 6699, 6763, Blank 70, Range 125, 227, 1765, Marloth 4655.

Blank notes that the natives eat the fruit which may indicate that it is more juicy than in var. A.

While the specimens enumerated above can, on the whole, fairly easily be sorted out as belonging to different varieties and forms, I have seen a large number of others which I cannot readily assign to these varieties, yet I do not think it advisable at present to place them under special named varieties or forms. The difficulties encountered may be illustrated by Bolus 88, collected in a kloof on a mountain side near Graaf-Reinet, alt. 3,500 feet, with flowers and young drupes.

This is quoted by Engler (l.c. 411) under *Rh. excisa* Thunb. *β pallens* Sond. It is sufficiently distinct from *Rh. pallens* E. et Z. 1114 to prevent us from placing it with it. Its leaflets vary in length from 7 mm. to 2·8 cm.; they are either slightly or decidedly "varnished"; they are usually obovate-cuneate or broadly oblong-cuneate, rarely obovate. The cuneate lower portion narrows, either gradually or somewhat suddenly. The apex is entire, obtuse or acuminate or mucronate, rarely emarginate or crenate. The petiole is either slightly margined or distinctly winged. Other forms placed under var. *pallens* Sond. in Herb. Kew and Berlin show so much diversity that again one cannot find any tangible characters to keep them separate, e.g. Burchell 2850, 2871, 2991, 4214, 4726, Drège (named *Rh. mucronata* Thunb.), MacOwan 504 from Grahamstown, Marloth 10347 from Beaufort West, Bolus 5290 from Mitchell's Pass.

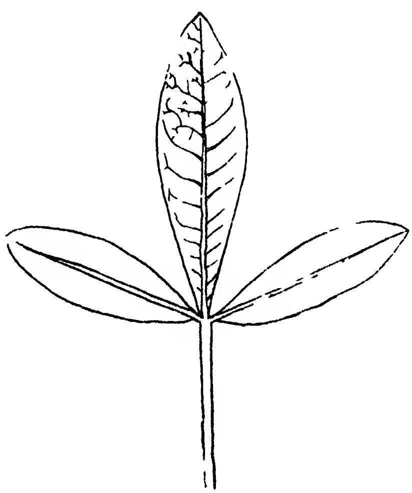
The following belonging to *Rh. undulata* cannot, without re-examination, be placed by me under any of the varieties here constituted: Waterval Onder, Lydenburg district, Burtt-Davy 396.

There can, further, be no doubt that this species sometimes hybridizes with others. Perhaps Paterson 3362, collected at Humewood, near Port Elizabeth, is such a hybrid. It has puberulous branchlets.

ECKLONIANA group.

33. **Rh. eckloniana** Sond. l.c. 515; *Rh. tridactyla* E. et Z. in Enum. 1095 (non Thunb.); *Rh. angustifolia* ? *α* Thunb. herb.; *Rh. margaretae* Burtt-Davy Ms. *Rh. Schoenlandii* Engl. in Pflanzenwelt Afrikas III, 2, 215 (Daly and Gane 747).

Description: A usually glabrous dwarf shrub, rarely over 2 feet in height, with purple angular branchlets. Leaves petiolate. Petioles subterete, furrowed above. Leaflets sessile, often more or less folded along the midrib, oblong or lanceolate-oblong, often mucronate, cuneate at the base, margin entire, slightly thickened and often white when dry. Midrib sunk above, very prominent below, lateral veins subparallel, slightly branched towards the margin, very slightly prominent below, tertiary veins inconspicuous. Panicles lateral in the upper portions of the branches and terminal equal in length to the leaves or slightly shorter or longer, rather lax. Bracts small subulate. Calyx segments ovate, bluntish. Petals oval. Drupe shiny, glabrous, subglobose.



Rh. eckloniana **Sond. Dyer 4601. Under side. (Leaflets often folded along midrib.)**

Petioles 1–2 cm. long.
Terminal leaflets 1·5–3·8 cm. long, 5–10 mm. broad.
Lateral leafflets ½ to ¼ shorter.
Pedicels about 1–2 mm.; calyx-segments about ¾mm.; petals 1½–2 long.
Drupe 5·5–6 mm. in diameter.

DISTRIBUTION: From the Elands River, in the Uitenhage division, to Bothas Hill and Blaauwkrantz, near Grahamstown, also Roundhill, chiefly on dry ridges, flowering chiefly in the late summer and fruiting in winter, Orange Free State and the Transvaal.

Ecklon 310, Z. 2230, Cooper 2173, 1538, Bolus 10638, Daly and Gane 747, Rogers 3108, Galpin 2906, Britten 2767, 5160, Baur 1092 are typical *Rh. eckloniana* from south-eastern Cape Province. E. et Z. 1095 are cultivated specimens, wrongly distributed as *Rh. tridactyla* Burch. Drège's specimens were distributed as *Rh. laevigata* L. *fol. long. integra* E. Mey. *b*.—There is a slight resemblance to the genuine *Rh. laevigata* L. (non Thunb.) in shape of leaflets, inflorescence, etc., but the venation of the leaflets is different.

Many of the Transvaal specimens are more or less pubescent, or even in young portions subvillous (*Rh. margaretae* Burtt-Davy), e.g. Schlechter 3539, Moss 2957, Gilfillan in Herb. Galpin 1495, but the following are quite glabrous: Galpin 1495, Burtt-Davy 15138 (=15060), Schlechter 3539*a*, Keet 5166 in Herb. Alb. Mus. These last range from Parys (O.F.S.), Vereeniging to Barberton, and cannot be distinguished from typical *Rh. eckloniana*.

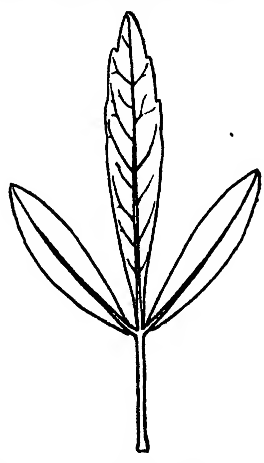
In various specimens it was found that the number of floral parts was increased to six or seven.

34. **Rh. Engleri** Britt. in Journ. of Bot. XXXVIII, 1900, 316.

Rh. incana Engl. l.c. 420 (non Mill.); Diels l.c. 581, 630.

DESCRIPTION: A much branched shrub or small tree, about 12 feet high, with spreading sometimes spinescent branches. Branchlets short, terete, the young ones densely greyish pilose. Leaves petiolate, petioles, subsemiterete, furrowed above, sometimes slightly winged, greyish pilose. Leaflets membranous, sessile, oblanceolate, obtuse or emarginate, margin often slightly revolute, entire or slightly crenato-dentate, upper surface dull green with puberulous midrib, and sometimes the lateral veins slightly prominent and greyish pilose, lower surface greyish pilose, the midrib and the few lateral veins somewhat prominent. Panicles lateral and terminal, pilose, laxly flowered, equal to or twice the length of the leaves. Bracts minute. Calyx lobes oblong, triangular. Petals yellowish, oblong. Drupe somewhat asymmetrical, laterally compressed and often umbonate on one side of the apex, brown, glabrous, shining.

Length of petioles 8–10 mm.
Length of terminal leaflets 2·5–3·5 cm. Breadth of terminal leaflets 6–7 mm.
Lateral leaflets usually about two-thirds the size of the terminal, sometimes shorter
Length of pedicels 1–2 mm.; calyx lobes about ¾ mm.; petals 1½ mm.
Greatest diameter of drupes about 3 mm., height about 4 mm.



Rh. Engleri Britt. Galpin 2919. Under side.

DISTRIBUTION: Transvaal Bushveld (Rehmann), Naboomspruit, Wakkerstroom, Waterberg district, Potgietersrust, Rooikop.

Rehmann sine no; Rogers 19004; Galpin 8472, M 64; Leendertz 1147, 1500, Pole Evans 2930, Baily 933.

The fruit is similar to that of *Rh. Marlothii* Engl., but its affinities generally seem to be with the species with which it is associated here. Engler places it next to *Rh. Welwitschii*, an Angolan species, and close to *Rh. divaricata* E. & Z. The latter has longer petioles, longer petals, different fruit, etc.

Mr. E. E. Galpin gives the following notes on some of his specimens:--

Locality · Farm Roodepoort, Springbok Flats, 8 miles south-east Naboomspruit Station, Altitude 3,750 feet.

Nature of Ground, etc.—Typical Springbok Flats red heavy loam derived from amygdaloidal basalt. On level plains in Sweet Acacia veld. In small bush clumps associated with *Acacia Karroo, Acacia litakunensis, Acacia robusta, Euclea lanceolata*, and *Ehretia hottentotica*, etc. Frequent.

Average height 12 feet. Stem 4-6 inches diameter.

Wood red brown and fairly tough. Used occasionally for pick-handles, but not nearly so good as that of *Rhus incana* [--this should be *pyroides*.—S. Sch.].

Local name Karaa, as distinguished from Karee the name for *Rhus lancea*.

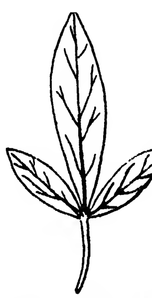
Sesuto name Mphapashane, which is also applied to *Rhus Gueinzii*. Very frequently attacked by hairy caterpillars, by which many trees are completely defoliated every year.

35. **Rhus eburnea** Schonl. n. sp.

DESCRIPTION: Frutex fastigiatus 1½-1¾ m. altus ramulis teretibus adscendentibus pubescentibus, foliis petiolatis, petiolis pubescentibus supra canaliculatis foliolis terminalibus brevioribus; foliolis supra saturate viridibus infra pallidioribus utrinque sparse pilosis lanceolatis vel oblongis basi cuneatis apice acutis vel acuminatis margine integris costa supra canaliculato infra valde prominenti nervis parce ramosis distinctis sed immersis; paniculis laxis axillaribus et terminalibus quam folia longioribus rarius brevioribus, bracteis floriferis minutis, floribus pedicellatis, calycis segmentis acutis petalis oblongis subtriplo brevioribus, drupa subglobosa eburnea exocarpo coriaceo.

Petioles about 1 cm. long.
Leaflets: terminal ones about 2·5 cm. long; lateral one-third to one-half shorter, 6-8 mm. broad.
Panicles 3-4·5 cm. long. Floral bracts about ¾ mm. long. Pedicels usually 2 mm. long.
Calyx segments about ½ mm. long. Petals about 1¼ mm. long.
Drupe about 3 mm. in diameter; about 3½ mm. high.

The yellowish white drupes usually show a few reddish thin irregular lines and bear at the apex a small black remnant of the styles.



Rh. eburnea Schonl. Keet 1547. Upper side.

DISTRIBUTION: Eastern Transvaal at an altitude of 2,500 to 4,000 feet.

Keet 1547—Marieskop forest reserve, Pilgrims Rest district (formerly Lydenburg), Dec. (fl., fr.).

Mr. Keet writes: " The bush forms one of the chief constituents of the 'fynbos' on the edge of the forests and generally along foothills and slopes from 2,500 to 4,000 feet, being mixed usually with a species of *Euclea*, a sp. of *Royena*, and with *Cliffortia linearifolia*. It is found on all aspects and on soil from both granite and sandstone formations. The reserve is situated about 30° 40′ East and 24° 30′ South."

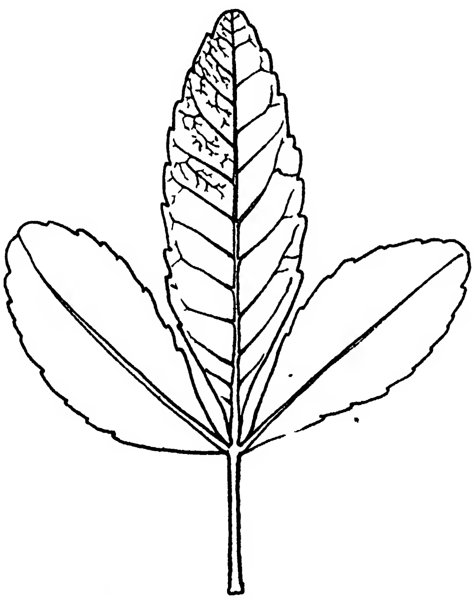
The vegetative organs resembles those of *Rh. eckloniana* (*Rhus margaretae* Burtt-Davy), but the fruit is different, the panicles longer in *Rh. eburnea*, etc.

NATALENIS group.

36. **Rh. natalensis** Bernh. in Krauss Beitr. (1844) 46; Sonder l.c. 515; Engler l.c. 421; Diels l.c. 587, 631; *Rh. glaucescens* A. Rich. Tent. Fl. Abyss. I, 143; *Rh. crenulata* A. Rich. Tent. Fl. Abyss. I (1847) 142; *Cissus natalensis* Bernh. in sched.

DESCRIPTION: A glabrous shrub 8–10 feet high with greyish subterete branchlets. Leaves petiolate, petioles broadly canaliculate above. Leaflets subcoriaceous, dark green above, light green below, broadly oblong, cuneate at the base, obtuse or emarginate at the apex; margin crenate-dentate, or subentire, rarely entire, slightly revolute; midrib prominent on both surfaces or sunk on the lower, lateral veins slightly prominent or immersed, tertiary veins immersed, reticulate, barely visible as a rule. Panicles axillary, often smaller than the leaves, lax. Flowers greenish yellow, calyx segments ovate, petals oblong. Drupe glabrous, yellowish brown, a little compressed and depressed.

Length of petioles 1–2 cm.
Length of terminal leaflets 4·5–5 cm. Breadth of terminal leaflets 1·8–2·3 cm.
Lateral leaflets nearly three-quarters the size of the terminal.
Length of calyx segments ½ mm.; petals 1·5 mm.
Greatest diameter of drupe 5–6 mm.



Rh. natalensis Bernh. Schonland 4025. Under side.

DISTRIBUTION: From about 11 miles west of East London along the coast to the borders of the Tropics, and widely spread in Tropical Africa to Abyssinia, and varying there to a considerable extent, but a number of specimens placed in European herbaria under *Rh. glaucescens* Rich. should be excluded; in many others the material is quite insufficient to allow [illegible] determination.

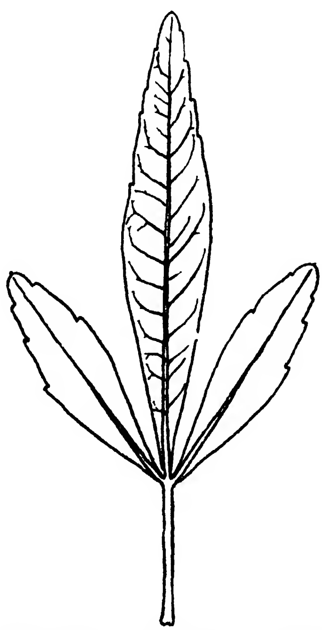
Diels has associated this species with *Rh. crenata* Thunb. in his *Crenata* group (l.c. 630) characterized (l.c. 597) by " crenate leaflets with glands predominating ". While there is no decisive evidence against this procedure, I do not think it advisable to follow it. He placed the closely allied *Rh. Marlothii* into his *Damarensis* group (l.c. 627), the characterization of which (l.c. 597), to my mind, is the same as that of the *Crenata* group (" Crenate leaflets. Indument strongly inclined towards reduction ").

Port Natal, Krauss 395 in Herb. Kew ; Overton in forest 11 miles west of East London, Hilner 281 ; Port St. Johns, in bush near beach, Schonland 4025 ; Embotye, Pondoland, near sea-level, Fraser 73/15/A (5101), 37/38/A (5154), (5088) ; Durban, from near sea-level to 100 feet, Wood 8729, 1713, 1136, Gueinzius. Rudatis 1481 ; Moss and Rogers 1708 (labelled " above Kirstenbosch, Cape ". which is evidently a mistake).

37. **Rh. Simii** Schonl. n. sp.—*Rh. glaucescens* Sim (non Rich.) in " Forests and Forest Flora of South Africa " (1907) 195, t. 49, fig. 1.

Description : Frutex divaricatus inermis vel spinosus vel arbor parvus ramis griseis, ramulis pubescentibus ; foliis petiolatis petiolis gracilibus subteretibus supra canaliculatis foliolis brevioribus ; foliolis rigide membranaceis oblongis vel lanceolatis basi angustatis obtusis rarius emarginatis margine leviter incrassatis integris vel $\pm$ crenato-serratis supra glaucis subtus pallide rufescentibus costa utrinque prominenti nervis utrinque leviter prominentibus marginem versus integris vel furcatis et connatis, venis paucis vel nonnullis ; paniculis pubescentibus foliis brevioribus ex axillis foliorum superiorum et terminalibus subdensifloris ; floribus pedicellatis calycis segmentis ovatis subacutis extus parce puberulis petalis oblongis calyci subtriplo longioribus, disco in floribus masculis 5-crenato ; drupa subglobosa nitida.

Length of petioles 2–2·5 cm.
Length of terminal leaflets usually 5 -6 cm. Breadth of terminal leaflets about 1·3 cm.
Lateral leaflets not quite two-thirds the length of the terminal ones, but often broader than these.
Length of calyx segments ½ mm. ; petals 1¼–1½ mm.
Diameter of drupe about 3·5 mm.



Rh. Simii Schonl. Sim 2127. Under side.

Distribution : Woods at Toise River and Komgha, flowering in autumn, and Komati Poort (var. *lydenburgensis* Schonl.).

Sim remarks that this species varies considerably in leaf-form and sometimes resembles wide-leaved forms of *Rh. lancea.* Its wood is sometimes used for hoe-handles as it is light and tough.

Sim includes in this *Rh. Gueinzii* Sond., which is not justified. Its affinities are with *Rh. natalensis* Bernh., which differs from it in many vegetative characters and has larger fruits. It may perhaps have to be sunk in *Rh. spinescens* Diels.

Toise River, 3,500 feet, Sim 2127; Komgha, Flanagan 797.

var. *lydenburgensis.*—This has the same fruit as the type, but differs from it in the following characters: Leaflets green and more thickened at the margin. The thicker branches armed with short thorns. Common in the low veld at Komati Poort, 600–700 feet; also grown in hedges, Keet 1431 (5158).

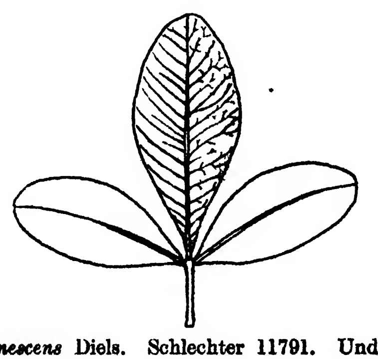
I append a full DESCRIPTION as it may have to be separated as a distinct species or united with *Rh. spinescens* Diels: -

Frutex divaricatus spinosus, ramis adultis spinis crassis ad 6·2 cm. longis armatis, ramulis brevissime pubescentibus subangulatis; foliis petiolatis, petiolis gracilibus subteretibus supra leviter canaliculatis foliolis brevioribus, foliolis glaberrimis rigide membranaceis oblongis basi angustatis obtusis rarius emarginatis margine incrassatis breviter crenato-serratis supra saturate viridibus subtus pallidioribus costa utrinque prominenti nervis supra immersis vel leviter prominentibus subtus leviter prominentibus ±ramosis; paniculis laxifloris lateralibus et terminalibus foliis brevioribus; floribus ignotis; drupa subglobosa nitida.

Length of petioles c. 2·5 cm.
Length of terminal leaflets up to 5·8 cm., rarely much shorter.
Breadth of terminal leaflets about 1·3 cm.
Length of lateral leaflets 3–3·5 cm.
Diameter of drupe 2–2·25 mm.

38. **Rh. spinescens** Diels in Engl. Bot. Jahrb. XL (1907) 87.

DESCRIPTION: A shrub about 8 feet high, with pale branches, the lateral often thorny, branchlets greyish pubescent. Leaves petioled, petioles slender, semiterete, canaliculate above, very sparingly pilose. Leaflets papery, glabrous or on the veins very rarely a little hairy, above deep green, below pale glaucous, oblong or oblanceolate, margin very narrowly revolute, subundulate, midrib slightly prominent on both surfaces, secondary veins distinct, but not raised, tertiary veins not visible. Panicles densely pubescent with whitish hairs, shorter than the leaves. Calyx segments broadly ovate, truncate, glabrous, petals ovate, obtuse. Drupe (in Keet 1493) subglobose, glabrous, shining, brown, slightly depressed, sometimes retaining the styles.



Rh. spinescens Diels. Schlechter 11791. Under side.

Length of petioles 1–1·5 cm.
Length of terminal leaflets 3–3·5 cm. Breadth of terminal leaflets 8–10 mm.
Lateral leaflets nearly two-thirds the length of terminal.
Length of calyx segments ½ mm.; petals 1·2–1·5 mm.
Diameter of drupe 4 mm.

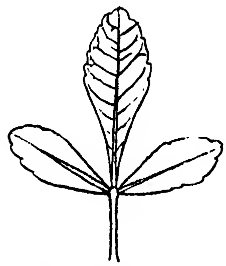
DISTRIBUTION : Komati Poort, common in the low veld.
This species is closely allied to *Rh. Simii* Schonl.

Komati Poort, Schlechter 11791 ; ib., common in low veld, Keet 1493.

39. **Rh. Marlothii** Engl. in Bot. Jahrb. X, 37, Pflanzenwelt Afrikas III, 2, fig. 182 ; Diels l.c. 581, 627.

DESCRIPTION : An unarmed shrub with minutely puberulous or shortly pilose branchlets. Leaves petioled, petioles sulcate above, puberulous or pilose. Leaflets subcoriaceous, puberulous or pilose, obovate-oblong or oblong, cuneate at the base ; margin in the upper part slightly crenate ; midrib prominent on the lower surface, lateral veins delicate, more or less immersed, tertiary veins not visible. Panicles at the end of the branchlets, axillary shorter than the leaves, terminal usually a little longer, puberulous, lax. Calyx segments puberulous, ovate, petals oblong. Drupe glabrous, shining, distinctly compressed, very often somewhat asymmetrical and sometimes crowned by the hardened subcuspidate styles.

Length of petioles 5–12 mm.
Length of terminal leaflets 2·1–4·5 cm. Breadth of terminal leaflets 1–1·8 cm.
Lateral leaflets about two-thirds the size of the terminal.
Length of calyx segments ½ mm. ; petals 1¼ mm.
Greatest diameter of drupe about 4 mm.



Rh. Marlothii Engl. Marloth 1394. Under side.

DISTRIBUTION : South-West Protectorate, Bechuanaland Protectorate, Transvaal. It flowers in summer.

This species is clearly allied to *Rh. natalensis* and not to *Rh. crenata* Thunb. as Engler thought. In its fruit it may approach *Rh. populifolia*. On the other hand, it also approaches *Rh. Gerrardi*, and thus forms a connection with the *Lancea* group. It is a somewhat variable species. Engler has indicated a var. *robusta* (Dinter 1711 = *Rh. tsemubensis* Dinter in Herb. S.A. Mus.) and a var. *subintegra* (Dinter 691, etc.), but I find that the length of the leaflets, their more or less pronounced crenation and the amount of their hairiness cannot be used to establish even fairly well-defined varieties. In Dinter 69 it was noticed that the rudimentary stamens in the female flowers remain even when the fruit is ripe.

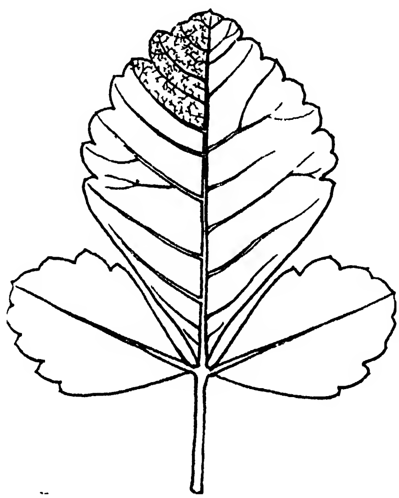
Otyimbingue, Hereroland, c. 2,700 feet, Marloth 1394 ; river scrub, Bullspoort, Dinter 2712 (leaflets smaller than usual) ; Wilhelmsburg, near Okohandja, Dinter 69 ; other specimens from South-West Protectorate : Engler 6469, Hartman 217, Waibel 50, 50*b*, Dinter 347, 1711, Fritsch 24, 130, and the following which would fall under Engler's var. *subintegra* : Dinter 691, Engler 6219, 6302, Seiner 835, Fritsch 63 ; Mochudi, Rogers 6628. Pietpotgietersrust, Bolus 1021 and Burtt-Davy 2205 (*Rh. Engleri* var. *fulvescens* Burtt-Davy).

40. **Rh. commiphoroides** Engl. et Gilg in Warb. Kunene-Sambesi Exped. 289.
Rh. kwebensis N.E. Br. in Kew Bull. 1909, 100.

DESCRIPTION : A much branched shrub up to 7 feet high with greyish, densely pilose branchlets. Leaves petiolate, petioles densely pilose, subterete, slightly channelled above. Leaflets subcoriaceous, glaucous, paler on the under side, pubescent on both sides, ovate or obovate or elliptic-oblong, cuneate at the base (the terminal often much contracted);

obtuse at the apex; margin flat, coarsely crenate or bicrenate, except in lower portion of the leaflets, which is entire; midrib and lateral veins generally depressed on upper surface, prominent on the lower, tertiary veins finely reticulate, inconspicuous. Panicles lateral and terminal, pubescent, multi-branched with clusters of pedicelled flowers. Calyx segments ovate, obtuse, petals oblong. Drupe (in Dinter 2874) glabrous, subglobose, slightly depressed and compressed, whitish when ripe.

Length of petioles 1–1·3 cm.
Length of terminal leaflets about 5 cm. Breadth of terminal leaflets about 3 cm.
Lateral leaflets about half the size of the terminal leaflets and generally barely cuneate at the base.
Length of calyx segments about ½ mm.; petals 1¼–1½ mm.
Greatest diameter of drupe 4·5 mm.



Rh. commiphoroides Engl. et Gilg. Lugard 200. Under side.

DISTRIBUTION South-West Protectorate, Bechuanaland Protectorate, extending into Rhodesia.

N. E. Brown considered that it is allied to *Rh. Rehmanniana* Engl. I think it should be placed near *Rh. natalensis* Bernh. and is perhaps also allied to *Rh. Dinteri* Engl.

Kwebe hills 3,300 feet, Mrs. Lugard 200; Otjitjika, Dinter 2874, 2877; Tsumeb, Dinter 1684 (labelled *Rh. omahekae* N.E. Br.); Waterberg, Pole Evans 19317; Mochudi, Rogers 6318.

I have not seen *Rh. amboensis* Schinz in Bull. de l'herb. Boiss., Sér II, VIII, 639. (Ojavo in Ondongo, Ovampoland, Rautenau, bl. 31, 1.) According to the author it reminds one strongly of *Rh. commiphoroides*, but is clearly distinguished by smaller, conspicuously thicker leaflets (the terminal ones being 25–30 mm. long) more prominent nervature and smaller crenations. Schinz also noted that the sepals are slightly acute.

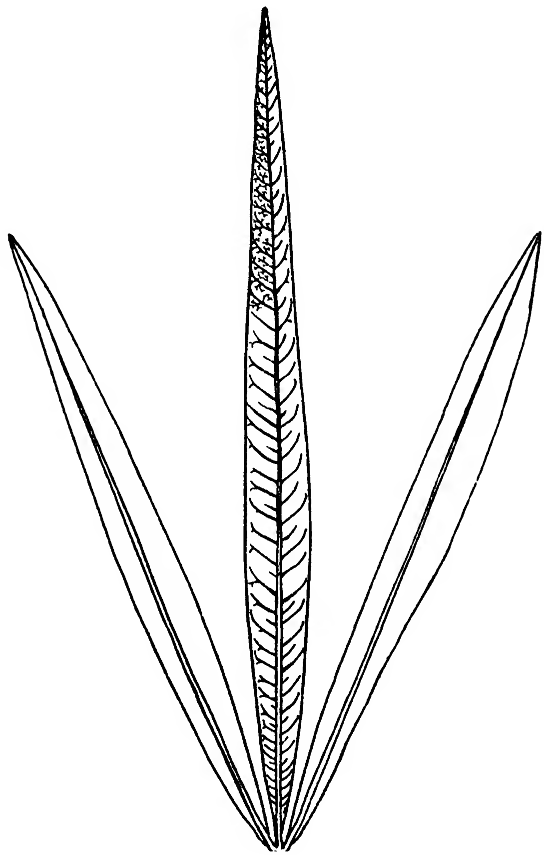
LANCEA group.

41. **Rh. lancea** L.f. suppl. 184; Linn. Syst. Veg. XIV, 294; Thunberg, Prodr. 52, Fl. Cap. ed. Schultes 263; Sonder l.c. 544; Engler l.c. 444; Diels l.c. 589, 640; Sim, Forest Flora 194, t. 46; *Rh. viminalis* Jacq. Hort. Schoenbr. t. 344 (non Vahl); Marloth, Das Kapland, 241, figs. 97, 101.

Rh. denudata Licht. in Roem. et Schult. Syst. VI, 661.

DESCRIPTION: Shrub or small tree (in South Africa seldom exceeding 20 feet in height) with the habit of a willow, quite glabrous, with elongated, angulate often reddish branchlets. Leaves petiolate, petioles long and slender, narrowly margined, concave above. Leaflets rigidly membranous or subcoriaceous, sessile, dark green and shining above, pale green below, linear-lanceolate, narrowed at apex and base, shortly mucronate, acute or rarely

obtuse, sometimes slightly falcate, entire; midrib conspicuous, raised on both surfaces, lateral veins branched towards the margin, slightly raised (often on the upper surface only), tertiary veins reticulate (usually plain on the upper surface only). Panicles lax, much branched, axillary (shorter than the leaves) and terminal (about as long as the leaves), bracts small, linear subulate, pedicels delicate. Calyx segments unequal (two short and two long ones and usually one intermediate between them), petals oblong. Drupe subglobose, slightly depressed, dull greyish to shining brown, often slightly asymmetrical



Rh. lancea L.f. Burchell 2728. Upper side.

Petioles 3–4 cm. long.
Terminal leaflets 9–12 cm. long; 6 mm. to 1·5 cm. broad.
Lateral leaflets usually nearly as long as the terminal leaflets and about as broad or slightly shorter and narrower.
Pedicels 2–3 mm. long. Calyx segments about ½ mm. long.
Petals almost 1¼ mm. long. Drupe 4–5 mm. in diameter.

Distribution : Widely spread in South-West Africa and the interior regions of South Africa wherever there is groundwater available and penetrating coastwards to the Oudtshoorn division, the arid parts of the Albany division, Fort Beaufort and King-williamstown divisions. (Recorded by Sim from Natal, but no specimen seen by me.) Occurs also in Rhodesia (reaching a height of 40–60 feet near Salisbury). Flowers generally from February to July.

Herb. Thunberg ; Jacquin (*Rh. viminalis* Jacq. non Vahl) : Drège in Herb. Kew and 3450 in Herb. Berol. (*Rh. viminalis* Vahl. *a*) ; on the Bushmans and Kat R., E. et Z. 1091 (*Rh. fragrans* Licht. ex Presl Bot. Bem. 41 ; Lichtenstein 194 in Herb. Berol. (*Rh. denudata* Licht.) ; on the Bushmans and Kat R., E. et Z. 1089 (*Rh. viminalis* Jacq. non Vahl) ; Burchell 2945, 3266 ; Great Namaqualand, Amboland, and Hereroland : Schultze 466, Range 411, 966 ; Schäfer 329, Dinter 288, 932, 988, Pfeil 87, 174, Francois 39*a*, Engler 6754, Trotha 16*a*, Seiner 174, Fritsch 64, Engler 6284, Pearson 3121, 4726, 9031 ; Calvinia, Diels 664 and 664*a* ; Hantam mountains, Meyer ; (Rondebosch, Hutton—evidently cultivated) ; hills near Matjesfontein, Schlechter 10923 ; in thickets along river beds near Schuurkraal, Karroo, Pearson 5000, 5030 ; Maggisfontein, Rehmann 2911 ; Pearson 1601, 4807 ; Oudtshoorn, Schoemanspoort, Britten 1651 ; Alicedale, Guden 306 ; Piggot Bridge, Dyer 915 ; Table farm, near Grahamstown, MacOwan 604, 1395 ; Herbert division and Griqualand West, Marloth 813, Anderson 691, Wilman 1 ; Mafeking, Shantz 232 ; Orange Free State : Rehmann 2880, Smith 4365, Burtt-Davy 10730 ; Transvaal (widely spread, especially common near Pretoria) : Leendertz 188, Burtt-Davy 534, Galpin 6991, Zahn 1684, Engler 2819, Shantz 248, Nation 297, Meune 2984, Burtt-Davy 2211, Galpin 5172, 5173, 8472, etc.

Specimens from Rhodesia which I have examined : Penther 96 ; Matopos, Galpin 7066 ; Salisbury, Eyles 1759 ; Bulawayo, Rogers 51. In the last two the terminal leaflets reach a length of over 16 cm.

Burchell No. 2728 in Herb. Berol. has leaflets only 2–3 mm. broad, and was distinguished by Engler as " forma angustissima ".

Specimens from a plant collected by Keet (No. 1434) in fruit at Magnet Heights, Lydenburg district (29° 55′ E., 24° 50′ S.), alt. 4,500 feet, though close to *Rh. lancea* may be distinct. It forms a small tree about 6 feet high in bushveld on " Norita " formation associated with *Acacia spirocarpoides*, *Olea verrucosa*, etc. The texture and venation of the leaflets is the same as in *Rh. lancea*. They are relatively broader (terminal leaflets about 6 cm. long, 1½ cm. broad), often blunt, sometimes wavy on the margin, sometimes sparsely and irregularly toothed, the teeth being small and blunt as in *Rh. Gueinzii*. The fruit is dull grey, shining, slightly depressed and compressed (?), 6 mm. in greatest diameter. Perhaps a hybrid ?.

42. **Rh. viminalis** Vahl, Symb. III, 50 (non Jacq. nec E. et Z.) ; Thunb. Fl. Cap. ed. Schultes 263 ; Sonder l.c. 515 ; Engler l.c. 442 ; Diels l.c. 588, 640.

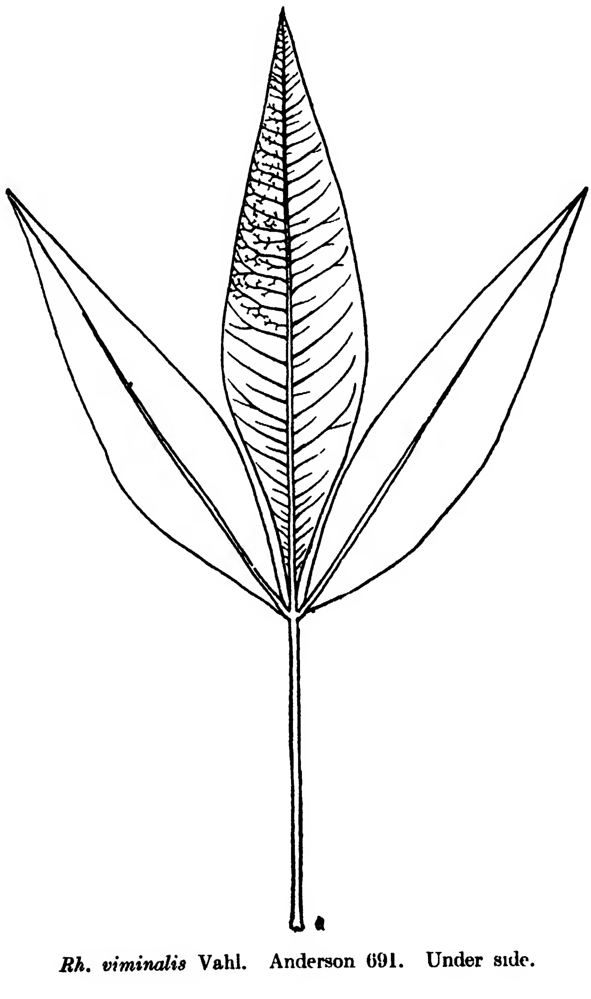
Rh. laevigata Herb. Jacquin (non L. nec Thunb.) ; ***Rh. denudata*** E. et Z. in Enum. 1090 (non Licht.) ; ***Rh. elongata*** E. et Z. in Enum. 1097 (non Jacq.) ; ***Rh. pendulina*** Jacq., Willd. Enum. 324 ; ***Rh. Wildingii*** Dehnh. Revist. nap. I, 3, 172 ; ***Rh. fragrans*** Licht. in Roem. et Schult. Syst. VI, 661 ; ***Rh. pallida*** E. Mey. in Drège exsicc.

Description : Willowlike bush or small tree (up to 30 feet in height) with elongated, glabrous, terete or subterete, often reddish branchlets. Leaves petiolate, petioles slender, subsemiterete, furrowed above. Leaflets sessile or subpetiolulate, membranous, subconcolorous (only slightly paler below than above), glabrous or finely ciliate, oblong-lanceolate, cuneate at the base, at the apex acuminate or acute, minutely mucronate, with entire, sometimes slightly undulate margin ; midrib slightly raised on both surfaces, lateral veins distinct but barely raised, tertiary veins indistinct, reticulate. Panicles hirsute, multibranched with delicate ramifications, but ultimate branches somewhat densely flowered, axillary shorter than the leaves, terminal longer. Calyx segments ovate, acute, often hirsute on the outside. Petals oblong. Drupe subglobose.

Petioles 1·5–4 cm. long.
Length of terminal leaflets 4–8 cm. Breadth of terminal leaflets ·9–1·7 cm.
Lateral leaflets usually slightly exceeding three-quarters the size of the terminal leaflets.
Calyx segments ½ mm. long. Petals 1¼ mm. long. Drupe 4 mm. in diameter.

DISTRIBUTION: On the banks of rivers and vleys in Clanwilliam, Namaqualand, Bushmanland, on the banks of the Orange River to Griqualand West, also at Graaff-Reinet, flowering from September to January.

Sonder (l.c. 515) has distinguished a var. *pendulina* (= *Rh. pendulina* Jacq., Willd. Enum. 324; *Rh. pallida* E. Mey., in coll. Drège). The characters by which he tries to distinguish it are, however, of not much use. I have seen the original specimens of Jacquin in Herb. Vienna. The branches have rather lanky growth and have evidently been pendulous, but in herbarium specimens generally it is not advisable to try to distinguish this variety.



Rh. viminalis Vahl. Anderson 691. Under side.

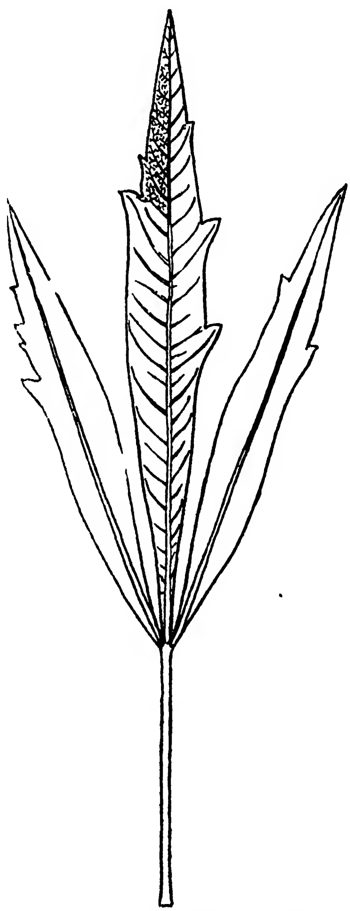
Specimens cultivated at Capetown, E. & Z. 1090; near Twenty-four Rivers (Clanwilliam), E. & Z. 1097; Namaqualand, near Klipfontein, Herb. Norm. Afr. 450 (Bolus 6526); Namaqualand, Pearson 6135, 6098; Bushmanland, Pearson 2582; near Doornpoort waterhole, Orange River expedition, 1910–11, Pearson 3136; Ramansdrift, Pearson 3112; Sendlings Drift, Pearson 1550, 6098; Verleptpraam, Orange River, Drège 3035; banks of Orange River, Pearson 3102 (some leaves extraordinarily broad, up to 2·3 cm., approaching an ovate form); Mazelsfontein, Griqualand West, Wilman 691; river banks near Graaff-Reinet, Bolus 134 (this was named *Rh. villosa* L.f. var. *glabrata* by Sonder).—(Schimper 163 from Amba Sea, Abyssinia, which was distributed as *Rh. viminalis* Vahl is *Rh. retinorrhoea*).

43. **Rh. Gerrardi** Harv. Ms.; Diels l.c. 588, 623.

Rh. viminalis var. *Gerrardi* Engl. l.c. 422.

DESCRIPTION: A shrub or small tree with at first pilose, later glabrous, subterete branchlets. Leaves petiolate, petioles slender, subterete with a shallow furrow above, at first pilose, later glabrous. Leaflets membranous, sessile, narrowly oblong or oblanceolate or oblong-ovate, narrowed at the base and generally also at the apex, which usually ends in an acute point; surfaces subconcolorous, at first pilose, later more or less glabrous; margin irregularly (and usually sparsely) crenato-dentate, especially towards the apex, teeth very shortly mucronate; midrib prominent, especially on the lower surface, lateral and tertiary veins delicate, but slightly prominent and very distinct, especially on the upper surface, the latter reticulate. Racemes axillary and terminal, shorter than the leaves or the terminal slightly longer, narrow, fairly compact (not diffuse as in *Rh. viminalis*) subglabrous in the type. Flowers pedicellate forming small glomerules, greenish yellow. Calyx lobes ovate. Petals oblong. Drupe?

Length of petioles 1·4–2·25 cm.
Length of terminal leaflets 4–6 cm. Breadth of terminal leaflets about 8 mm.
Lateral leaflets generally about four-fifths the size of the terminal leaflets.
Length of pedicels 1–1½ mm.; calyx lobes ¾–1 mm.; petals 1¼–1½ mm.
Diameter of drupe?



Rh. Gerrardi Harv., A. *typica*. Schlechter 3771. Upper side.

Distribution: Basutoland, Tembuland, Natal (above 3,000 feet), eastern Transvaal, flowering in midsummer.

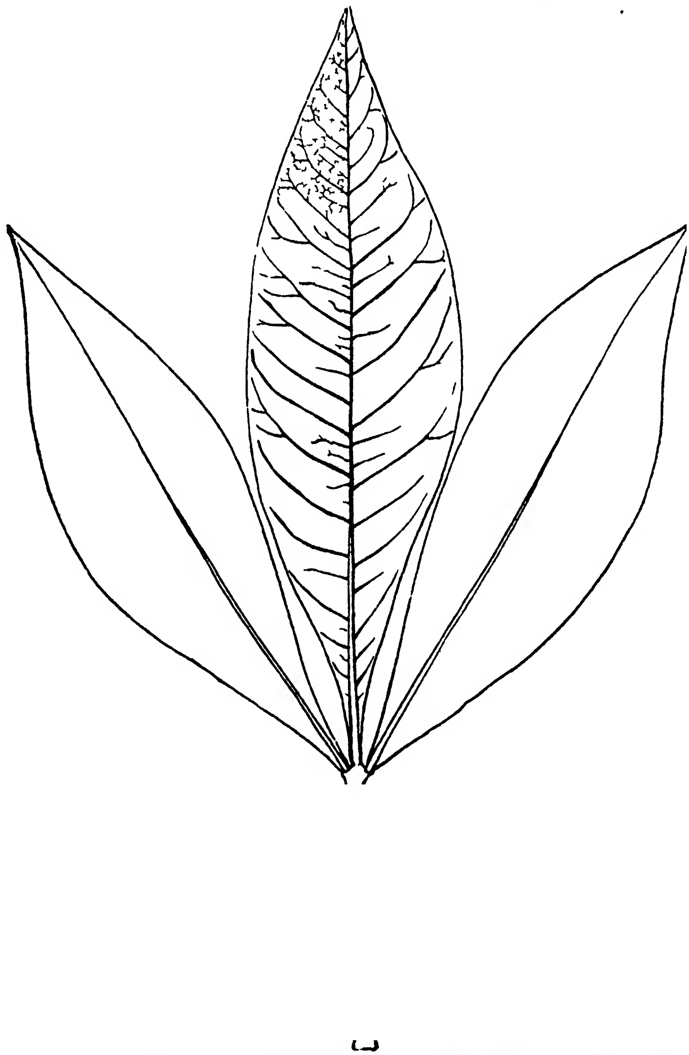
Uses: Used in Basutoland for building huts and for hedges at Lydenburg.

Four varieties may be distinguished.

A. *typica.*—

Natal, Gerrard 1396; Leribe, Dieterlen 691; near Emmans, Natal, Wood 3645; bank of Tugela, 4,000 feet, Wood 3632; Little Tugela, near Glockners, 4,000 feet, Wood 3632; Estcourt, 3,700 feet, Dimmock-Brown 91; near Colenso, Wood 6581; on the banks of the Olifants River, 5,000 feet, Schlechter 3771; Lydenburg, Schlechter 3963.

B. *latifolia.*—Leaflets larger and broader than in the type (up to 3 cm.). Inflorescence subvillous and young branches, petioles, and leaflets more hairy than the type.



Rh. Gerrardi Harv., B. *latifolia* Schonl. Evans 5096*a*. Upper side.

Basutoland, Dieterlen 1201; Zomershoek, Lydenburg district, Burtt-Davy 7564 (= Wilms 246, 247, 248 = *Rh. viminalis γ Gerrardi* Engl. forma *pilosa* Engl. in Herb. Berol.); Ishlet River, Piet Retief district, Forest Dept. Herb. 5974; Graskop, Lydenburg district, along river banks, Evans (5096*a*); Palmer's farm, Waterval, Lydenburg district, Burtt-Davy 5327.

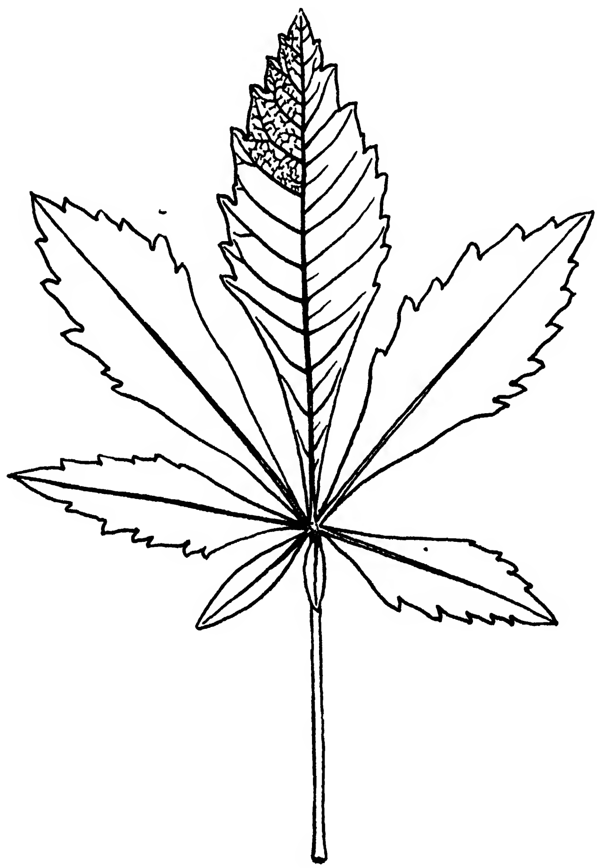
The following does not agree exactly with any of the foregoing as the leaflets are often dentate to near the base: Kaap River valley, near Barberton, Keet 1436. It is a small tree, 8–10 feet high. The drupes are red laterally compressed, generally broader than high. Their greatest diameter is 2½ mm., their height usually 2 mm.

C. *basutorum*.—Leaflets narrowly oblong or oblanceolate, acute at the apex, often mucronate, margin above the middle remotely and grossly dentate, teeth mucronulate, above subglabrous with the exception of the densely pilose midrib, below subtomentose, the prominent midrib and lateral veins densely pilose.

Of this I have only seen a single branch from Khanyane, Leribe district, Basutoland (Dieterlen 691, Herb. S.A. Museum 6065). It grows on mountain slopes and in ravines. It was named *Rh. viminalis* Vahl var. *Gerrardi* by Phillips in his "Flora of Basutoland."

The stem was simple, densely leafy, subterete, densely pilose. It bore female flowers on a terminal, lax panicle, barely equal in length to the leaves. I thought at first that it should be placed near *Rh. discolor* E. Mey., but as it is used for building huts it must be a large shrub or even a tree. In any case the resemblance to this species seems only to be superficial and is only due to the fact that an isolated branch was compared to it.

D. *montana*.—*Rh. montana* Diels in Engl. Bot. Jahrb. XL, 86, 639.—Branchlets and petioles glabrous. Leaflets 3–5 (rarely 6 or 7) foliolate, nearly glabrous or towards the margin slightly pilose, oblanceolate or obovate oblong, grossly crenato-serrate, teeth mucronulate. Panicle slender, longer than the leaves, pilose (as are also the ovate lanceolate calyx segments).



Rh. Gerrardi Harv., D. *montana* (with 7 leaflets). Bolus 8837. Under side.

This has only been collected at Engcobo, Tembuland, by H. Bolus (No. 8837).

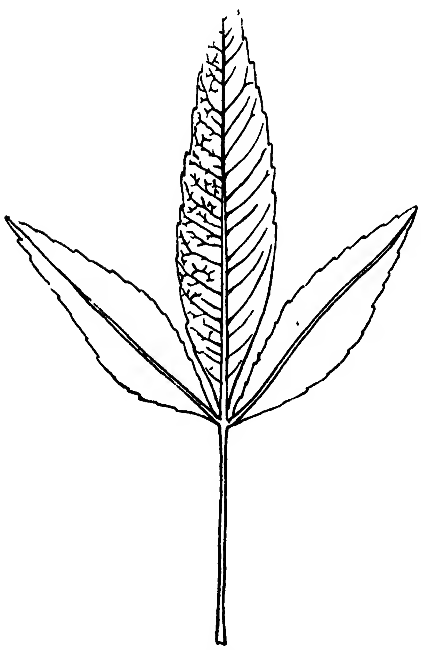
I append a translation of Diels' account, adding here and there a few additions and corrections in square brackets :—

"Shrub with brown glabrous branches. Petioles semiterete, slender, at the base enlarged and sheathing, glabrous. Leaves 3–5 foliolate. Leaflets papery, glabrescent or towards the paler margin a little hairy, below pale, towards the base gradually narrowed, otherwise oblanceolate or obovate-oblong, grossly [crenato-] serrate, teeth mucronulate, midrib prominent below, lateral veins a little prominent below, tertiary veins immersed. Inflorescence slender, exceeding the leaf; calyx segments triangular [ovate-lanceolate], slightly hairy, petals ovate-elliptical, twice longer [immature drupe glabrous, globose].

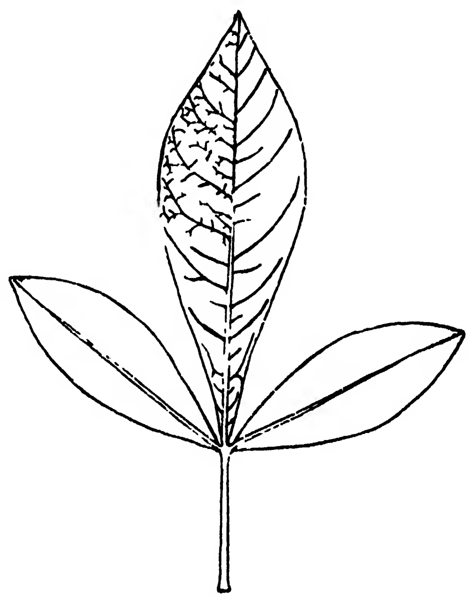
"Petiole about 3 cm. long, terminal leaflet about 6 cm. long, 2–2·5 cm. broad; lateral leaflets about 3–4 cm. long, 1·2–1·5 cm. broad. The inflorescence reaches a length of 10 cm. The sepals are 1·5 mm. long [barely $\frac{3}{4}$ mm.], the petals 2·5 mm. long [$1\frac{1}{4}$–$1\frac{1}{2}$ mm.]."

44. **Rh. Gueinzii** Sond. l.c. 515; Engler l.c. 442, p. pte, Diels l.c. 589, 623, p. pte.

DESCRIPTION: A glabrous shrub or small tree 12–15 feet high, with slender, flexuous greyish or reddish, subterete or somewhat angular branchlets. Leaves petiolate, petioles slender, subterete, slightly canaliculate, especially towards the apex. Leaflets membranous, dull green above, lighter below, sessile, lanceolate or oblong-lanceolate, from below the middle cuneate, acute or obtuse at the apex, often mucronulate, margin slightly revolute,



Rh. Gueinzii **Sond. Howlett 4. Under side.**



Rh. microcarpa Schonl. (5025). Upper side.

with a small blunt tooth at the end of each lateral vein; midrib raised on both surfaces, lateral veins delicate, distinct, but barely raised, tertiary veins reticulate, indistinct. Panicles axillary, nearly as long as the leaves and terminal, slightly longer than the leaves, very lax. Calyx segments about $\frac{1}{2}$ mm. long, petals greenish yellow oblong. Drupe in the type (Gueinzius 1395) subglobose, verrucose, in Transvaal specimens generally brown, smooth or almost smooth, slightly asymmetrical, compressed or depressed.

Petiole 1·5–3·5 cm. long.
Terminal leaflets 4–7 cm. long; about 1·4 cm. broad.
Lateral leaflets slightly smaller than the terminal.
Pedicels 1–2 mm. long. Calyx segments ½ mm. long. Petals 1¼–1½ mm. long.
Drupe (in Gueinzius 1395) about 4 m.m. in diameter and greatest diameter in Transvaal specimens about the same.

Distribution: Common in the Transvaal. The type (Gueinzius 1395) in herb. Kew which I have examined is supposed to have come from Natal. It flowers in February.

Mr. E. E. Galpin supplied the following information on his No. M 721:—

"Bastard Karee—Mphapashane (Sesuto name, but also applied by them to my No. M 64).

"Frequent in sand veld on the Springbok Flats, associated with *Acacia caffra* and *Peltophorum africanum*, and occasional in rooibosveld (a light sandy loam of reddish colour carrying a zuurveld vegetation typified by *Combretum apiculatum*, the local name for which is Rooibos) in association with *Combretum apiculatum*.

"Also frequently found in granite soil on the mountain slopes west of Naboomspruit.

"Its timber is greatly inferior to that of the other local species of *Rhus*, being twisted and very brittle and of little value. The amount of serration on the leaves varies considerably in different trees, and on some it is much more pronounced than on the tree from which the specimens now sent you were gathered."

Modderfontein, Konrath 112; Rustenburg, Nation 167; Potgietersrust, Burtt-Davy 2184; Magaliesberg, Engler 2770; Wonderboom farm, Burtt-Davy 4100; Groenkloof, Pretoria, Howlett 2 and 4; Pretoria kopjes, Leendertz 54, 174; boschveld between Elands River and Klippan, Rehmann 5144; Naboomspruit, Galpin M 721; Naboomfontein, Schlechter 4305; Zeerust, Burtt-Davy 90; Kaap River valley, near Louws Creek, Keet 1486; Pietersburg district? Grenfell 14, 16.

There are two rather stiff branches without flowers in Herb. Alb. Mus. with somewhat more oblong and slightly thicker leaves than in *Rh. Gueinzii*. They were collected at Pretoria (L. Reck No. 13, Colonial Herb. 1090). It is suggested that these are coppice shoots of *Rh. Gueinzii*. They agree remarkably well with the type of *Rh. leptodictya* Diels in the Berlin Herbarium, with which they have been compared (from tree-steppe, Bulawayo, Engler 2915).

45. Rh. microcarpa Schonl. n. sp.

Description: Frutex ramulis teretibus subvillosis. Folia petiolata, petiolis gracilibus dense pilosis supra canaliculatis. Foliola membranacea glauco-viridia subtus pallidiora, oblonga vel obovata, basi saepius valde angustata, apice acuta mucronata, primum utrinque dense pilosa deinde sparse pilosa, margine integra, costa venisque prominulis, venis reticulatis indistinctis. Paniculae dense pilosae laxae, axillares quam folia breviora, terminales longiores, floribus pedicellatis. Calycis lobi ovati. Petala oblonga. Drupa parva applanata.

Length of petioles 1–2 cm.
Length of terminal leaflets 4–6·5 cm. Breadth of terminal leaflets 1·5–2 cm.
Lateral leaflets generally a little over half the size of the terminal leaflets.
Length of pedicels ½–1 mm.; calyx lobes ¼–½ mm.; petals about 1¼ mm.
Diameter of drupe about 2½ mm.

Distribution: Natal, flowering in midsummer.

Ingwangwe forest reserve, P.O. Riverside, about 4,000 feet, Household (5008, 5025); Ngomi, near Vryheid, Government forester (5147); Harding, 3,700 feet, D.F.O. (5054).

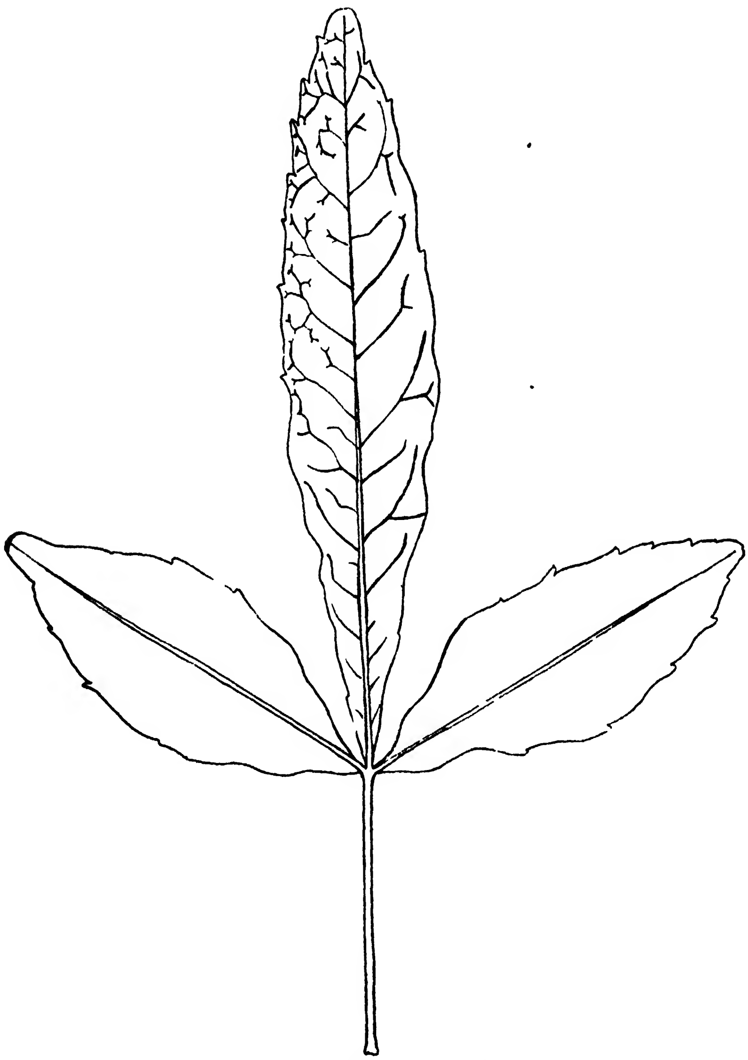
This distinct species is, on the one hand, close to *Rh. Gerrardi* var. *latifolia*; on the other hand, it leads up to *Rh. pyroides* Burch. var. *puberula* and may have been derived from Its height is 3–6 feet. It is common at Ingwangwe.

46. Rh. crispa Harv. Ms.; *Rh. Gueinzii* Sond. var. *crispa* Engl. l.c. 443.

Description: Arbor parvus ramulis gracilibus glabris teretibus. Folia petiolata, petiolis glabris gracilibus subteretibus supra profunde canaliculatis. Foliola glabra, membranacea saepius crispa supra saturate viridia subtus pallidiora, oblonga vel lanceolato-oblonga basi angustata apice obtusa, margine undulata vel subplana, rarius crenata, costa

utrinque prominula, venis paucis arcuatis utrinque leviter prominulis, nervis reticulatis indistinctis. Paniculae axillares quam folia breviorae laxae pubescentes, floribus parvis pedicellatis. Calycis lobi oblongo-ovati. Petala late oblonga. Drupa . . . .

Length of petioles 2–3 cm.
Length of terminal leaflets 5–8·5 cm. Breadth of terminal leaflets 1–2 cm.
Lateral leaflets one-half to two-thirds the length of the terminal leaflets sometimes broader than these.
Length of panicles 4–6 cm.; pedicels about 1 mm.
Length of calyx lobes and petals not fully developed in the material available.
Diameter of drupe ?



Rh. crispa Harv. Pegler 1446. Under side.

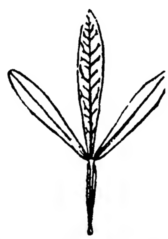
DISTRIBUTION: Natal and Kentani district (Transkei).

Natal, Gerrard 1397; Kentani district, overhanging stream, 1,200 feet, Pegler 1446 (fl. buds in February).

47. **Rh. ciliata** Licht. in Herb. Willd; Roem et Schult. Syst. Veget. VI, 661; DC. Prodr. l.c. 71; Sonder l.c. 519; Engler l.c. 418; Diels l.c. 576, 628; *Rh. tridactyle* [sic !] Burch. trav. I, 340; *Rh. tridactyla* Sond. l.c. 516; Engler l.c. 446; Diels l.c. 590, 641.

Description: A small shrub, not more than 6 feet in height, with spreading, stiff, unarmed or thorny, glabrous or puberulous branchlets. Leaves petioled, petioles subterete or slightly winged, canaliculate above, glabrous or puberulous. Leaflets subcoriaceous, concolorous on both surfaces, glabrous or puberulous on lower surface and then often ciliate on the margin, linear or lanceolate, rarely oblong, narrowed at the base, at the apex obtuse, or sometimes mucronulate, more rarely subacute, straight or more rarely falcate, margin entire; midrib slightly sunk on upper surface, slightly prominent on lower, secondary veins arising at a very variable angle, sunk or fairly distinct, but rarely slightly prominent. Panicles glabrous or puberulous, axillary and terminal of variable length, very lax. Calyx segments ovate, petals oblong. Drupe subglobose, a little compressed.

Length of petioles about 10–13 mm.
Length of terminal leaflets 1·5–2·5 cm. (rarely shorter or longer, up to 5 cm.).
Breadth of terminal leaflets about 3 mm. (rarely up to 4 mm.)
Lateral leaflets about two-thirds the length of the terminal leaflets, often a trifle broader than these.
Length of panicles 1·5–6 cm., pedicels 1½–2 mm., calyx lobes about ¾ mm., petals about 1¼ mm.
Greatest diameter of drupe 4-5 mm.



Rh. ciliata Licht. Wilman 1255. Under side.

It is impossible to separate *Rh. tridactyla* and *Rh. ciliata*. Hairy specimens may be found in localities with glabrous forms. Armed or unarmed specimens occur also in the same localities. There is also some variety in the shape of the leaflets, in the conspicuousness of the lateral veins, in the breadth of the petiole, etc. In some respects this species approaches *Rh. longispina* E. et Z.

Distribution: South-West Protectorate, and portions of northern Cape Province, Bechuanaland, Orange Free State, and western Transvaal, flowering from December to March.

Herb. Lichtenstein at Berlin (type of *Rh. ciliata* Licht.); Klaarwater, Griquatown, Burchell 1946 in Herb. Berlin (*Rh. concinnum* Burch. Ms.); Asbestos mountains, Burchell 1667, 2131 (types of *Rh. tridactyla* = Wilman 1339, 1255); Hay division, Karreefontein, Wilman; Dummery, Wilman 2252, 2254; Griqualand West, at Baaksfontein, Klein Greef Puts, Klein Papkuil, Wilman 1255; Kimberley, Noran 13315, Wilman 2150, 2151, Marloth 835. (distributed as *Rh. puberula* E. et Z.), MacOwan 2573, 2574; near Mafeking, Bolus 6404; near Vryburg, Rogers 26791; near Christiana, Bloemhof district, Burtt-Davy 1614, 12850; Schoenheid, Bloemhof district, Burtt-Davy 9405; Naval Hill, Bloemfontein, Potts 75, Drège 6804*a*; Orange River, Z. 339 and Burke 504; Rhenosterkop, near the Vaal River, Z. 337 and Burke 275; Olifantsfontein, Orange Free State, Rehmann 3518; Ottoshoop, Transvaal, Engler 2901; Wolmaransstad, Rogers 18487, 20617.

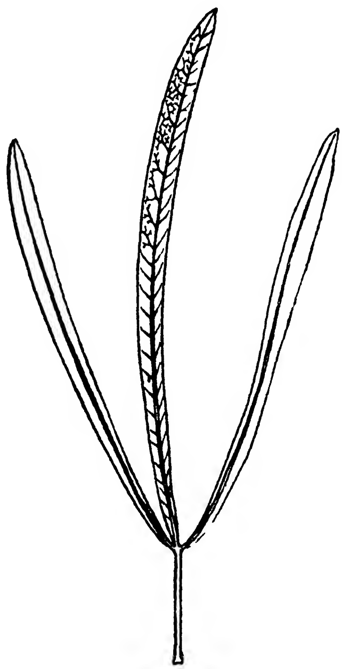
forma *fastigiata* Schonl.—Similar to the type, except that it has a fastigiate (not squarrose) mode of growth and the lateral veins are more prominent on the under side of the leaflets, but Engler 6218 and 6227 connect extreme forms with the type. Dinter mentions that it is 1 m. high and grows in masses on grassy plains.

South West Protectorate: Ankas, Dinter 833; Otjosandjon, Seiner 142; Ovampoland and North Hereroland, Engler 6218, 6227.

48. **Rh. dregeana** Sond. l.c. 516; Engler l.c. 445; Diels l.c. 590, 625, 641, fig. 6 D, 625.

DESCRIPTION: A small, much branched glabrous shrub, generally not over 3 feet in height, with squarrose or ascending, sometimes purpurascent slightly angulate branchlets. Leaves petioled, petioles margined. Leaflets coriaceous, subconcolorous, shining above, narrowly linear, sometimes slightly falcate, narrowed at the base, at the apex acuminate, shortly mucronate; margin entire; midrib slightly prominent on both surfaces, other veins indistinct. Panicles very lax, axillary shorter than the leaves. Calyx lobes ovate, obtuse, petals oblong. Drupe subglobose, yellowish, shining, slightly fleshy when ripe.

Length of petioles generally about 1 cm.
Length of terminal leaflets 3·5–6 cm. Breadth of terminal leaflets 1·2–2·5 mm.
Lateral leaflets generally two-thirds the length of the terminal leaflets and about as broad as these.
Length of pedicels 2–3·5 mm.; calyx lobes about $\frac{3}{4}$ mm.; petals about $1\frac{3}{4}$ mm.
Greatest diameter of drupe 5·5 mm.



Rh. dregeana Sond. Bolus 43. Under side.

Diels (l.c. 641) remarks: "What has been placed together as *Rh. dregeana* Sond. represents perhaps less a strict monophytic connection, but rather the artificial union of several branches of *one* type." This type is perhaps *Rh. ciliata* Licht., from some of the glabrous forms of which it is not separated by good technical characters. The leaflets in *Rh. dregeana* are, however, more pointed and generally much longer, the flowers and fruits larger, etc. [*Rh. trifoliolata* Bak. f. in Journ. of Bot. XXXVII (1899) 429 coll. by Rand (No. 66) at Bulawayo is very close to *Rh. dregeana*. Here, however, in most of its leaflets the lateral veins are very distinct.]

DISTRIBUTION: Mountains of north-eastern Cape Province and also in the Orange Free State near Spionkop, between Philippolis road and Smartryk, flowering in autumn.

Sneeuwberge, Drège 2374; Mooiplaats, Stormberge, 4–6,000 feet, Drège 3448; near Graaff-Reinet, 2,500 feet, Bolus 135; Sneeuwberge, 4,000 feet, Bolus 43; Graaff-Reinet, Sr. Francis 29; Burchell 2853 (sub *Rh. lancea* L. f.); Burghersdorp, 5,000 feet, Flanagan 1530; in gorge below Buffels River waterfall, Basutoland, circ. 7,100 feet, Galpin 6599; near Philippolis, Orange Free State, circ. 5,050 feet, Smith 4489 (rare).

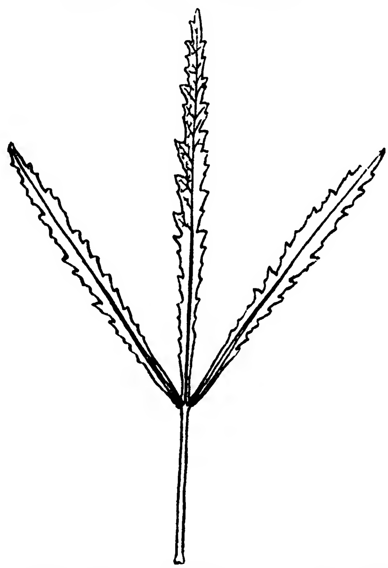
49. **Rh. erosa** Thunb. in Fl. Cap., ed. Schultes 363; Sonder l.c. 516; Engler l.c. 439; Diels l.c. 587, 595, 624, 625, fig. 6 A, B, C, 642.

Rh. serraefolia Burch. trav. II, 100.

DESCRIPTION: A much branched glabrous, sometimes decumbent shrub with subflexuous branchlets, usually 3–6 feet high, sometimes reaching a height of 10 feet and up to 30 feet across. Leaves very variable in size, petioled; petioles slender, margined, canaliculate above. Leaflets coriaceous, usually "varnished" (especially on the upper side), linear, sometimes slightly falcate, narrowed towards the base, acute; margin in a varying degree eroso-dentate or sometimes entire on the same plant, teeth acute; midrib prominent on both surfaces, lateral veins more or less prominent on both surfaces, tertiary veins usually indistinct or not visible. Panicles very lax with slender branches, usually somewhat shorter than the leaves, bracts very small. Calyx segments unequal, obovate, very obtuse. Petals obovate. Drupe yellowish, shining, subglobose.

Length of petioles 2–3 cm.
Length of terminal leaflets up to 12 cm. Breadth of terminal leaflets (without teeth) 2–5 mm.
Lateral leaflets similar to terminal leaflets, usually about three-quarters of their lengths.
Length of pedicels 2–3 mm.; calyx lobes about ½ mm.; petals about 1 mm.
Diameter of drupe about 4 mm.

Known as "Bezenbosch." Native name Tselabelo.



Rh. erosa Thunb. Phillips 3121. Upper side.

DISTRIBUTION: Stony kopjes, usually frequent, in the mountainous districts of the Midlands and north-eastern Cape Province, Basutoland and Orange Free State (Rogers 2484 has been distributed with the erroneous locality "Table Mountain, Capetown").

It is used for making rough brooms and thatching sheds. Grown in gardens it is quite ornamental. Phillips notes that the witch doctors in Basutoland use it for "rain-making and as a medicine for diarrhœa in man and cattle." It is also used as a hairbrush by Kaffirs in the Orange Free State.

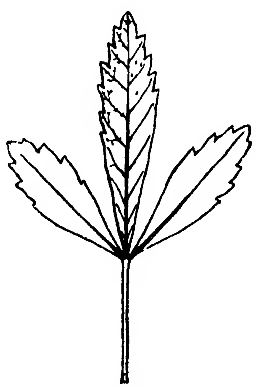
Herb. Thunberg; Burchell 2729, 2697 (in Herb. Kew, etc.); Koutveld mountains, near Murraysburg, 5,000 feet, Tyson 142; Graaff-Reinet, 3,300 feet, Bolus 535, Bowker 39; common near Grootfontein, Middelburg, C.C., Schonland; near Rosmead station, Flanagan 1529; Cradock division, Z. 346, Cooper 476, Kuntze; Somerset East, Atherstone 171; Roode Rand Farm, near Klaas Smits River, 3,550 feet, Galpin 2512; Winterfield, Drège 813; Shiloh, Drège, E. et Z. 1133, Baur 909; Cala, Pegler 1742, ; Colesberg, Shaw 40; Majuba Nek, and Sterkspruit, Herschel division, Hepburn 250, 33; Leribe plateau, Basutoland, 5–6,000 feet, Dieterlen 78, Phillips 842; Bethlehem, Phillips 3121; Potts 3309, Bloemfontein, Rehmann 3832 (var. *subintegra*, Sozysoz.), 3795, Potts 56; Ladybrand, 6,000 feet, Patterson (5076); near Ficksburg, Potts 3165; near Trompsburg, Orange Free State; near Fouriesburg, Potts 3276.

50. **Rh. Bolusii** Sond. Ms.; Engler l.c. 436; Diels l.c. 584, 626.

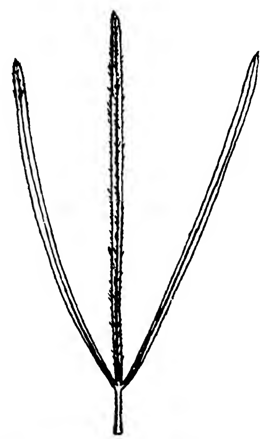
This species has only been collected by Bolus near Graaff-Reinet, and may have to be dropped in view of Diels' statement (l.c. 626) that in a plant of the Berlin Bot. Gardens (1854) the leaflets of *Rh. erosa* are distinctly broadened, and thus assume entirely the appearance of *Rh. Bolusii* Sond. He is, therefore, inclined to look upon the latter as a local form of *Rh. erosa.* He explains that its occurrence is possibly due to a favoured habitat which might produce a form like the one produced under cultivation. Perhaps a slight indication that this view is correct may be the fact that Mr. R. A. Dyer found in one flower of Bolus' plant a sixth petal which was smaller than the others. Similar abnormalities are often found in cultivated plants. The flowers are larger than in *Rh. erosa.* Diels' views mentioned do not tally with his statement (l.c. 585) that he thinks that *Rh. dentata* Thunb. is its nearest relation. Engler placed it next to *Rh. oxyacantha* Cav. found on the Cape Verde Islands and in the Mediterranean Region.

DESCRIPTION: A glabrous shrub with suberect, slender, flexuous branchlets. Leaves petiolate, petioles slender, slightly margined, canaliculate above. Leaflets subcoriaceous, somewhat shining above, obovate-oblong or oblong, narrowed towards the base and with acute, often mucronate apex, margin from below the middle or higher up serrato-dentate, teeth acute, subacute or blunt, midrib and lateral veins prominent, tertiary veins not visible. Panicles very lax with slender branches, bracts small ovate-lanceolate. Calyx segments ovate, bluntish or triangular, acute. Petals broadly oblong. Drupe . . . .

Length of pedicels 1·5 cm.
Length of terminal leaflets 2–3 cm. Breadth of terminal leaflets about 1 cm.
Lateral leaflets resembling the terminal leaflets and usually about two-thirds their length.
Length of pedicels 2–3 mm.; calyx segments about ¾–1 mm.; petals about 2 mm.



Rh. Bolusii Sond. Bolus 737. Upper side.



Rh. gracillima Engl. Rehmann 1882.
Upper side.

DISTRIBUTION: Cave Mountain, near Graaff Reinet, 3,900 feet, Bolus 737.

51. **Rh. gracillima** Engl. l.c. 445; Diels l.c. 590, 614.

DESCRIPTION: A very slender shrub, 2–4 feet high, unbranched, except when it reaches 3–4 feet, sparsely and patently pilose all over (except in var. *glaberrima* Schonl.). Leaflets shortly petioled, petioles canaliculate and slightly margined above. Leaflets coriaceous, concolorous, very narrowly linear, sometimes slightly falcate, narrowed towards the base

and at the apex very acute; midrib prominent on both surfaces, other veins not visible. Panicles very lax, and with very delicate branches, axillary ones generally slightly shorter than the leaves, sometimes much longer, terminal longer than the leaves, bracts small, subulate. Calyx segments ovate acute, petals oval. Drupe . . . .

var. *glaberrima* Schonl. [*Rh. filiformis* Schinz in Vierteljahrschr. d. naturf. Ges. in Zürich LV (1910) 239].—Glabrous and with longer leaves than the type.

Length of petioles 5–7 mm. (in var. *glaberrima* up to 15 mm.).
Length of terminal leaflets 6–7 cm. (in var. *glaberrima* up to 8 cm.).
Breadth of terminal leaflets 1·5 mm. (in var. *glaberrima* up to about 1 mm.).
Lateral leaflets very much like the terminal ones and almost as long.
Length of bracts 1 mm.; pedicels 1–2 mm.; calyx segments ¾–1 mm.; petals 1½–2 mm.

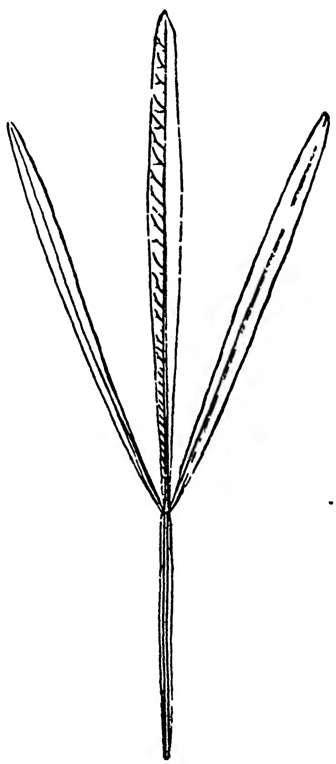
DISTRIBUTION: Transvaal.

Between Mienaarsfarm and Elands River, Boschveld, Rehmann 1882; Premier Mine, Rogers 22421. var. *glaberrima*—hills near Wilge River, 4,600 feet, Schlechter 3746 (fl. in Nov.).

52. **Rh. Wilmsii** Diels in Engl. Bot. Jahrb. XXIV (1898) 501, l.c. 589, 614, 641.

DESCRIPTION: A much branched glabrous shrub with slender branchlets. Leaves petioled, petioles rather long, distinctly margined, canaliculate above with a slight ridge in the centre of the channel. Leaflets concolorous, coriaceous, linear, narrowed towards the base, blunt or emarginate at the apex or narrowed into a mucro, margin entire or very slightly undulate, midrib very prominent on both surfaces, lateral veins prominent on both surfaces, tertiary ones not visible. Inflorescence, flowers, and fruit unknown.

Length of petioles 3–3·5 cm.
Length of terminal leaflets 7–9 cm. Breadth of terminal leaflets 4–7 mm.
Lateral leaflets very much like the terminal leaflets and not much shorter.

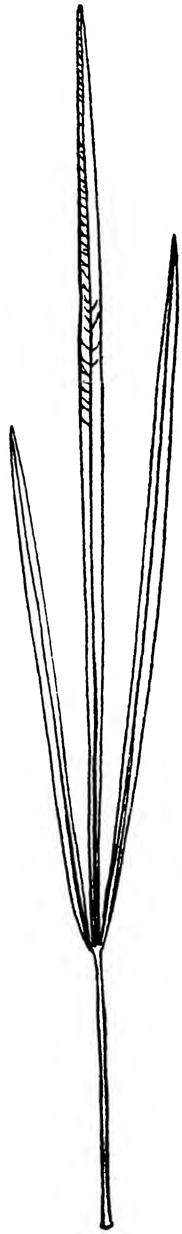


Rh. Wilmsii Diels. Wilms 249. Upper side.

DISTRIBUTION: Only found by Wilms (No. 249) at the large waterfall, Lydenburg, Transvaal.

53. **Rh. Keetii** Schonl. n. sp.

DESCRIPTION : Frutex glaberrimus gracillimus circ. 1 m. altus saepius simplex vel apicem versus parce ramosus cauli basi vix 5 mm. diam. superne tenuissimo vix 1·5 mm. diam. tereti ; foliis longe petiolatis, petiolis gracilibus supra canaliculatis vix alatis basi incrassatis foliolis anguste linearibus basi et apice angustatis summo acutissimis saepius ± falcatis utrinque subconcoloribus margine integris anguste albo-cartilagineis, costa utrinque prominenti, nervis vix prominentibus vel saepius immersis, foliolis lateralibus et terminalibus subaequalibus vel inaequalibus : paniculis terminalibus laxissimis bracteis parvis lanceolatis acutis, calycis segmentis ovatis basi contractis, petalis pallide flavis late oblongis, floribus foemineis cum staminodiis ; drupa subglobosa, leviter depressa.



Rh. Keetii **Schonl. Keet 1435.**
Under side.

Petiole 3½–5 cm. long (often curved), barely 1 mm. in diameter.
Leaflets, both terminal and lateral, 11–15 cm. long, about 3 mm. broad.
Calyx segments ¾–1 mm. long. Petals about 1·7–2 mm. long.
Drupe c. 5 mm. in diameter.

DISTRIBUTION: Only found near Lydenburg, Transvaal.

Keet 1345.—On the Klip River in Steelspoort Park, Lydenburg district, 30° 0′ E. and 24° 50′ S., 4,000 feet, June (fl. and fr.).

Mr. Keet notes: "Slender bushes about 3–4 feet high, mostly single-stemmed, stems pencil thickness. Found in grass-covered and very rocky places."

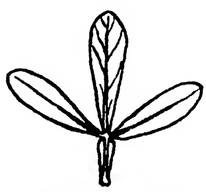
This species is closely allied to *Rh. Wilmsii* Diels from the same neighbourhood, of which the flowers and fruits are unknown. Perhaps it may have to be referred to it later as a variety, but I have thought it best to keep it separate for the present because in *Rh. Wilmsii* the petioles and leaves are not so slender, the wings of the petioles are more pronounced, the leaflets generally shorter and suddenly contracted at the apex, the lateral veins are prominent on both surfaces. In both species there is a narrow ridge in the middle of the channelled upper side of the petiole.

HORRIDA group.

54. **Rh. horrida** E. et Z. in Enum. 1135; Sonder l.c. 415; Engler l.c. 415; Diels l.c. 575, 635; *Rh. platypoda* E. Mey. in Drège exsicc.

DESCRIPTION: A shrub with rigid, patent, usually thorny branchlets. Young leaves, panicles, pedicels and calyx densely covered with grey or red glands. Leaves more or less fasciculate, petiolate, petioles distinctly winged. Leaflets coriaceous, linear-cuneate, obtuse, entire. All veins (including midrib) immersed. Panicles few flowered, axillary, shorter than the leaves. Pedicels very short. Flowers very small. Drupe oblique, glabrous, beaked with short styles.

Petioles 2–8 mm. long, usually ½ mm. broad.
Terminal leaflet 4–8 mm. long; 1–3 mm. broad.
Lateral leaflets a little shorter than the terminal.
Petals a little over 1 mm. long.
Drupe 4 mm. long; 5 mm. broad.



Rh. horrida E. et Z. Schlechter 11179. Under side. 3/2.

DISTRIBUTION: Namaqualand and Bushmanland, flowering throughout the summer.

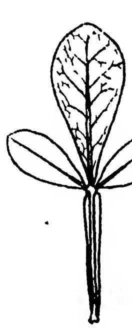
In sandy soil, alt. III, mountain sides of the Khamiesberg and in Namaqualand, E. et Z. 1135, Ecklon 35; Springbokkeel, Ecklon 45, Z. 348; hills near Rietkloof, 2,500 feet, Schlechter 11179; Drège in Herb. Kew (*Rh. platypoda* E. Mey. *b*).

55. **Rh. longispina** E. et Z. in Enum. 1135; Sonder l.c. 520; Engler l.c. 415; Diels l.c. 575, 635.

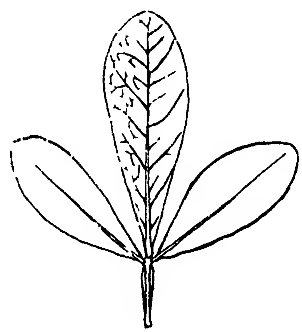
DESCRIPTION: A thorny squarrose shrub up to 10 feet high. Stem and branches grey. Young organs (branchlets, leaflets, panicles) covered with red glands, older ones glabrous. Branches short, 3–4 cm. long, and with thorny end or bearing short branchlets which turn into thorns. Leaves petiolate, mostly fasciculate, petioles very variable in length, more or less according to the size of the leaflets, usually winged, the wings varying in width even in leaves of the same size. Leaflets coriaceous, cuneate-obovate, obtuse or

subemarginate, entire, the lateral ones often oblong and slightly asymmetrical at the base. Midrib and lateral veins (which are not quite straight and branched towards the margin) raised on both surfaces, tertiary veins coarsely reticulate (not visible in small leaflets). Panicles numerous, usually clustered with the leaves, densely covered with red glandular hairs, usually slightly shorter than the leaves, with few and short side branches. Flowers shortly pedicellate. Calyx segments ovate, green. Petals pale yellowish, oblong, narrowed towards the base. Drupe green, sometimes turning brown, rather juicy at first, shining, subglobose, getting flattened when old, often asymmetrical, retaining sometimes the hardened styles.

Petioles 5 mm. to 3·5 cm. long and in exceptional cases up to 3 mm. broad.
Terminal leaflets 1·5 cm. long; 5 mm. to 2·2 cm. broad.
Lateral leaflets one-third to one-half the size of the terminal leaflets.
Pedicels 1 mm. long. Calyx segments barely ½ mm. long.
Petals about 1½ mm. long. Drupe 5-5½ m.m. in diameter.



Rh. longispina E. et Z. E. and Z. 1048. Upper side.



Rh. longispina E. et Z. Dyer 61. Upper side.

Distribution: In somewhat arid places from Swellendam to East London penetrating inland to Graaff-Reinet, usually flowering in late summer or autumn.

The affinities of this species seem to point to *Rh. rigida* though it is often placed near *Rh. lucida*. In some respects it also approaches *Rh. ciliata* Licht. The great variability of this species in the size of leaflets, the length and breadth of the petioles is noteworthy, and while in other species of *Rhus* great variability raises a suspicion of hybridization, such a suspicion cannot be entertained here.

Burchell 5381, 5383, 3312; Swellendam, Mund and Maire; hills near Mossel Bay, 50 m., Schlechter 5725; Keurboom R. hill, Duthie 747; Armoed, Britten 1747: west bank of Gamtoos River, near Hankey (Presl), 150 feet, Fourcade 2280; Uitenhage, Ecklon (labelled "*Rhus pterota* Presl"); ib., (Krakakamma) Z. 456, 2245; amongst bushes on the banks of the Zwartkops River, Ecklon 46, 1048; Uitenhage, Addo, and near Fort Beaufort, E. et Z. 1116; Redhouse, Paterson 2112; Aloes, J. L. Drège 3165; Sandflats, Rogers 191; Cookhouse, Rogers 2457; Graaff-Reinet, Bolus 660; commonage north of Grahamstown, Dyer 58, 61, 62; Otterburn, Fish River randt, Schonland; Nahoon River mouth, Galpin 5689.

On the farm Aylesby, near Riebeek East, two forms are found not far from one another. One has deep green leaflets; in the other they are grey. In the former the leaves are always a little larger than in the latter.

56. **Rh. rigida** Mill. dict. No. 14; Sonder l.c. 520; Engl. l.c. 416; Diels l.c. 576, 633, 634, fig. 7 L.

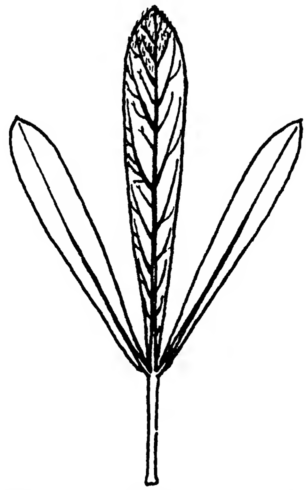
Rh. rimosa E. et Z. in Enum. 1134.

Rh. triceps E. Mey. in Drège exsicc.

Description: An erect, rigid, glabrous shrub about 1½–3 feet high, with approximate and sometimes purplish and resinous branchlets. Leaves shortly petiolate, petioles canaliculate above, narrowly margined. Leaflets rigid, coriaceous, somewhat glaucous, sometimes resinous, cuneate lanceolate or linear lanceolate, apiculate, concolorous on

both surfaces, margin entire or with one or two acute teeth at the apex; midrib slightly raised, immersed or slightly sunk on the upper surface, slightly prominent on the lower, lateral veins invisible or barely visible, tertiary veins invisible. Calyx segments ovate, petals oblong. Drupe glabrous, oval or oblong, compresseed and depressed, sometimes slightly oblique, tricuspidate.

Length of petioles 1–1·5 cm.
Length of terminal leaflets 4–5 cm. Breadth of terminal leaflets 5–8 mm.
Lateral leaflets about two-thirds the length of the terminal leaflets and about as broad as these.
Length of calyx segments about ¾ mm.; petals 1¼–1½ mm.
Greatest diameter of drupe about 6 mm.



Rh. rigida Mill. Pillans (5132). Under side.

Distribution: In the north of the south-west Cape region from the Winterhoek to the Giftberg. Flowers from September to November.

It is very difficult to suggest close affinity of this species with any others. Diels places it into his *Lucida* group. The fruit is very much as in *Rh. populifolia* E. Mey. and allies, but the vegetative organs are somewhat close to those of some forms of *Rh. magalismontana* Sond.

Sonder (l.c. 520) has separated as a variety Drège 6797 from the Giftberg with panicles more compound than in the type as long or longer than the leaves, but there seems to be no justification in keeping this up.

Drège in Herb. Kew (*Rh. triceps* E. Mey.); between Twenty-four River and Olifants River, Ecklon 45; mountains near Heerelogement, E. & Z. 1134 (*Rh. rimosa* E. et Z.); summit slopes of Pikenierspass, Pillans 5132; Packhuisberg, 2,000 feet, Schlechter 10798; Saron, 1,000 feet, Schlechter 7884; plains west of the Giftberg, on rocky places poor in vegetation, 300 feet, Diels 409 (this has a more straggling habit and shorter leaves than the type).

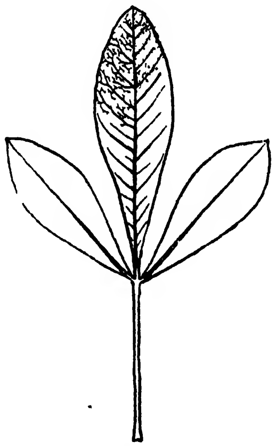
57. **Rh. magalismontana** Sond. l.c. 510.

Rh. burkeana Sond. l.c. 514; Engler l.c. 417; Diels l.c. 576, 639.

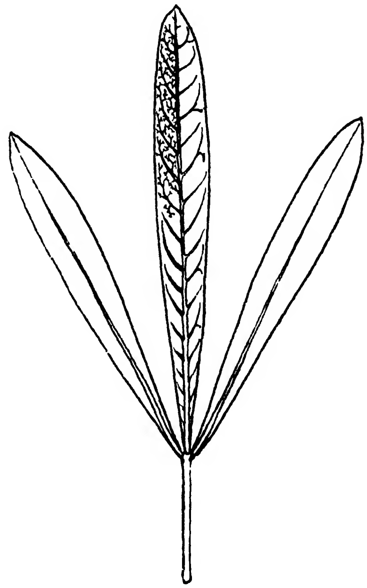
Rh. coriacea Engl. l.c. 418; *Rh. oblanceolata* Schinz in Beitr. zur Kenntn. d. afr. Flora XXI, Bull. de l'herb Boiss. 2 ième série VIII, 638.

Description: A much branched shrub with young branches, leaves and panicles shortly tomentose (tomentum often yellowish or fuscous), branchlets terete, striate. Leaves petiolate, petioles one-third to one-half the length of the terminal leaflets, broadly furrowed above, marginate, the margins slightly thickened. Leaflets subcoriaceous, sessile, often

glabrous when old, obovate oblong or oblong with a cuneate base and obtuse, rarely acute, mucronate apex; margin entire, not revolute; midrib prominent on both surfaces, the lateral and tertiary reticulate veins also usually fairly prominent. Panicles axillary and terminal, shorter than the leaves or a little longer, loosely flowered, bracts subulate, flowers pedicelled. Calyx lobes ovate-triangular, acute. Petals oblong. Drupe shining, subglobose.



Rh. magalismontana Sond. Moss 2969. Under side.



Rh. magalismontana Sond. Leendertz 1313. Under side.

Length of petioles 1–2 cm.
Length of terminal leaflets 3½–6 cm. (sometimes much smaller).
Breadth of terminal leaflets (average about 1 cm.).
Lateral leaflets about two-thirds the size of the terminal leaflets.
Length of calyx lobes about ¾ mm.; petals about 1¾ mm.
Diameter of drupe (Burtt-Davy 5332) barely 4 mm.

Distribution: Stony kopjes in the Transvaal.

Magaliesberg, Z. 11 (in Herb. S.A. Mus.), Engler 2812 (in Herb. Berlin), Burtt-Davy 2666; rocky places on the Aapies River, Z. 335 (type of *Rh. burkeana* Sond.); near Johannesburg, Galpin 1469, 1493, Moss 2969; Ottoshoop, Engler 2812; between the Drakensbergen and Pretoria, Wilms 244; near the Houdek, 4,800 feet. Schlechter 2733; near Pretoria and Klippan, Rehmann (type of *Rh. coriacea* Engl.); Warmbaths, Leendertz 1313, Burtt-Davy 5332; on the Olifants River, 5,000 feet, Schlechter 3773 (type of *Rh. oblanceolata* Schinz); Paardevalley, near Zeerust, Burtt-Davy 7183; northern Transvaal, Le Doux 4.

Diels (l.c. 630) states that in *Rh. burkeana* Sond. he found most typical sunk stomata such as he found in no other species of African *Rhus*. (See the illustration of his, Pl. XIV, S.)

DISCOLOR group.

58. **Rh. discolor** E. Mey. in Drège exsicc; Sonder l.c. 507; Engler l.c. 447; Diels l.c. 590, 614.

Rh. rufescens E. et Z. in Enum. 1093 (non Hamilton).

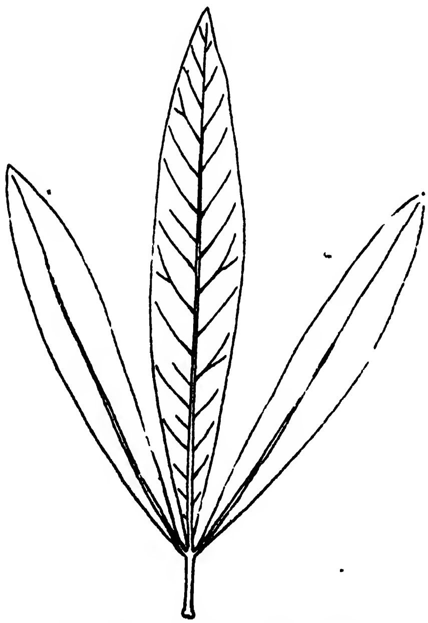
Rh. villosissima Engl. l.c. 447.

Rh. grandifolia Engl. l.c. 434.

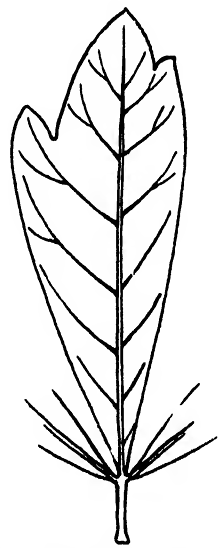
Description: A low poorly branched shrub, 1½–3 feet high, with densely grey or fulvoustomentose branchlets, petioles and inflorescences. Leaves petiolate, petioles short, semiterete, canaliculate above. Leaflets coriaceous, above green more or less pubescent or

pilose, rarely villous or glabrous, below more or less fulvous or whitish tomentose with adpressed hairs, rarely villous, the midrib and veins sometimes more decidedly pilose, linear lanceolate or lanceolate or oblong, rarely obovate, more or less cuneate at the base, apex usually acute, sometimes obtuse, usually mucronate; margin slightly revolute, entire or in the broader leaflets often more or less grossly dentate or rarely eroso-dentate; midrib not prominent or slightly prominent above, decidedly prominent below, lateral veins not prominent or even depressed above, not prominent or more or less prominent below, tertiary veins reticulate, but only sometimes plainly visible above, not visible below. Panicles dense, axillary a little shorter than the leaves and terminal, somewhat longer, branches short, multiflowered, flowers glomerulate, lower bracts foliaceous, lanceolate or linear, upper small linear. Calyx segments lanceolate acute or subovate, tomentose on the outside. Petals subovate. Drupe subglobose, when young sometimes puberulous, when ripe yellowish, subglobose, glabrous, shining, sometimes crowned with the enlarged styles.

Length of petioles 5–8 mm. (in rare cases up to 1·6 cm.; in one case up to 3·3 cm.).
Length of terminal leaflets 5–8 cm. (up to 16 cm. in *Rh. grandifolia*, 3½ cm. in Baur 912).
Breadth of terminal leaflets 1–1·5 cm. (7·5 cm. in *Rh. grandifolia*, 3 mm. in Baur 912).
Lateral leaflets about two-thirds to four-fifths the size of the terminal ones.
Length of pedicels barely 1 mm.; calyx segments ¾–1 mm.; petals 1¼–1½ mm.
Diameter of drupe 4–5 mm.



Rh. discolor E. Mey. Drège 1839.

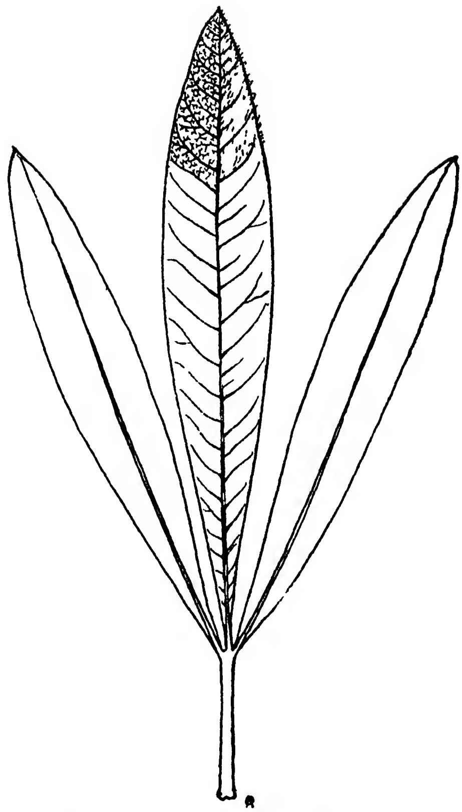


Rh. discolor E. Mey. Drège 1839.

DISTRIBUTION: Amongst grass and low shrubs on mountains of south-east Cape Province, Komgha division, Transkei, Pondoland, along the Drakensberg range, Natal, Orange Free State, Transvaal. Flowers from November to January.

Allied to *Rh. arenaria* Engl. (Angola).

Like so many other "species" of *Rhus*, *Rh. discolor* is extremely variable, which shows itself chiefly: (1) in the hairiness of the leaflets, ranging from glabrous upper surfaces through pilose ones to almost villous. *Rh. villosissima* Engl. was based on an extreme form. Already Diels (l.c. 590) has sunk this species in *Rh. discolor* and Engler has later done this also The former says: "die Behaarung wechs lt überall bedeutend"; (2)



Rh. discolor. E. Mey. Rogers 1693. Upper side

the shape of the leaflets. A broadening of these is especially seen in *Rh. grandifolia* Engl. but already in Meyer's type of *Rh. discolor* (in Herb. Kew) some leaflets are almost obovate-cuneate; (3) the broadening is usually accompanied by an increase in length; and (4) it is also usually accompanied by the appearance of irregular teeth in the upper part of the leaflets. These, however, are also already found sparingly in Meyer's type.

Taking extreme forms such as *Rh. grandifolia* Engl. (Rehmann, Inanda) and Baur 912, for which some measurements were given above, it seems almost incredible that they should have to be placed into the same species, but there is no other course open, since they are connected by intermediate forms.

Engler (l.c. 448) recognized two forms, in addition to the type:—

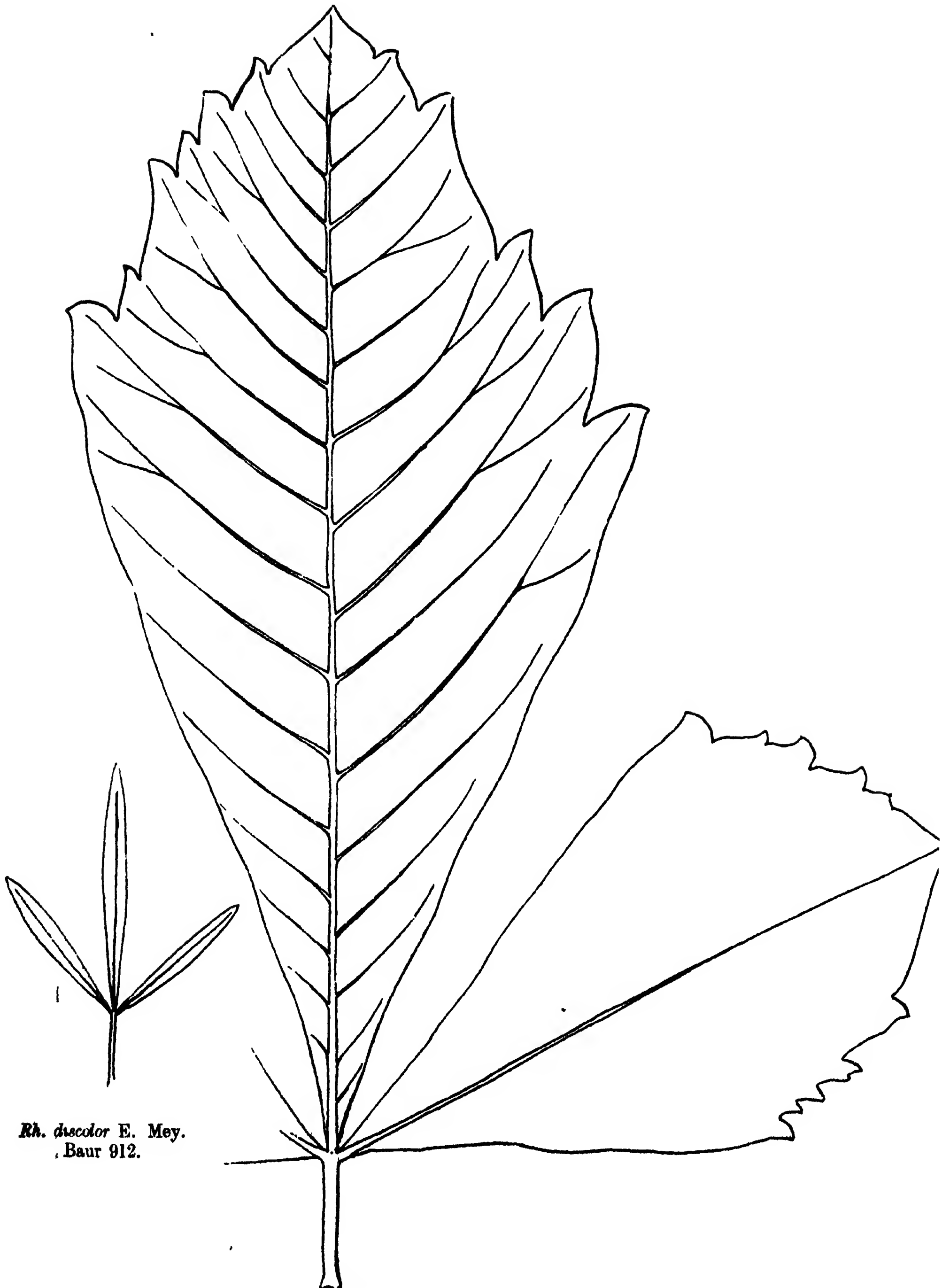
β paucinervis.—Leaves sometimes with five leaflets, leaflets acute, sometimes bidentate, lateral veins less numerous, ascending (not spreading).—None of the characters given, are distinctive.

Faku, Gerrard 1403 in Herb. Kew; Transvaal, Page's hotel, Rehmann.

γ brevifolia.—Leaves shorter, oblanceolate, 4–5 longer than broad.

Drakensberg, Rehmann in Herb. Berol.

This, again, cannot stand, as in Rehmann's type the terminal leaflet is up to 4·5 cm. long, which is not much less than what we find in other forms.



Rh. discolor E. Mey.
Baur 912.

Rh. discolor E. Mey., D. *grandifolia* (Engl.). Rehmann. (Tertiary veins reticulated.)

I propose to divide the species into the following forms: -

A. *typica*.—Leaflets lanceolate or oblanceolate, rarely broadened, mucronate, above pubescent. Lateral veins not prominent (or at all events not conspicuously so) on the lower surface. Terminal leaflets 5 7 cm. long, rarely slightly shorter or longer.

B. *villosissima* (*Rh. villosissima* Engl.).--Adult leaves more hairy on both surfaces, lateral veins generally very prominent on the lower surface. Shape of leaflets as in A, but usually slightly larger.

C. *latifolia*.--Leaflets ovate or obovate, entire or dentate. Lateral veins not prominent on the lower surface. As these veins are longer than in A and B they curve upwards. The leaflets reach a length of 11 cm.

D. *grandifolia* (*Rh. grandifolia* Engl.).—Leaflets obovate-cuneate, often grossly irregularly *eroso-dentate*, but on the same shoot there may be leaflets agreeing with A in shape. Adult leaflets glabrous above, reaching a length of 16 cm. Lateral veins prominent on lower surface.

A. Between Sandplaats and Komgha, Drège 3449, 5584 (one leaflet approaches c); Cowie Mt., Bedford, Bennie 281; Hogsback, c. 6,000 feet, Rattray 66; Katberg, MacOwan 864 (largest terminal leaflet 12 cm. long); Winterberg and Chumie mountain, E. et Z. 1093; mountain side, Gwetwyn farm, Queenstown division, Galpin 8301; N'Achbanya mountain, Queenstown division, Galpin 1903; hills near Shiloh, Baur 912 (in Herb. Berol. with the smallest leaflets known); Mvanyeni, near Cedarville, Griqualand East, Bandert 106*a* (leaflets almost linear, very narrow); Qumbu district, Dwyer 5111 (the collector notes that it forms *a* mass of underground roots which interfere with ploughing and that the drupes are eaten by children); Ntsubane, near Lusikisiki, Evans (5048, 5052); Ingwangwane, Household 5047; hills near Ladysmith, 4,000 feet, Wood 849; near Houderivier, c. 4,500 feet, Schlechter 3737; Majuba, Rogers 53; Magaliesberg, Burke 328; Johannesburg, Moss 6175; Carolina, Rogers 1152*a*; Wonderfontein, Nelson 259.

The following approach B: Barber 611; Matatiele, Hilner 26; Sterkspruit, Herschel district, Hepburn 2, 155; Pietpotgietersrust, Rogers; The Downs, Pietersburg division, Rogers 21879; Graskop forest station, Evans (5110).

B. Houtbosch, Rehmann 5557, Bolus 10999; Carolina, Rogers 11552; rocky mountain sides near Komgha, 2,000 feet, Flanagan in Herb. Austr. Afr. 1421; Kokstad, 4,700 feet; Camperdown, Alexandra county, Natal, Rudatis 1808; Klip River, near Johannesburg, Engler 2741; river bank near Lydenburg, Wilms 250.

C., Leribe, Basutoland, Phillips 551, 614, 844 (in the last number some of the leaflets are petiolulate, and the petiole reaches a length of 3·3 cm.); ib., Dieterlen 29; Drakensberge, Symons 7588; Mont aux Sources, McLean and Bayer 201; Besters Vley, near Harrismith, Bolus 8138, Flanagan 1864; Harrismith, Herb. Alb. Mus. 5142; hills near Ladismith, Wood 849; Culvers, Weenen district, Rogers; Johannesburg, Leendertz 1693; Irene, Leendertz 695; Ermelo, Tennant 6939; Potgietersrust, Rogers 5106

Specimens from Xalingena forest, Polela, Natal, Alb. Mus. Herb. 5011, may also be placed here. Others from Ntsubane, near Lusikisiki, Pondoland, Fraser 5149, 5150 have villous leaflets. This is also the case in the young leaflets of Dieterlen 29.

D. Inanda, Natal, 1,800 feet, Wood 742 (Wood says - Gerrard 1403. This number is quoted by Engler under his var. *paucinervis*).

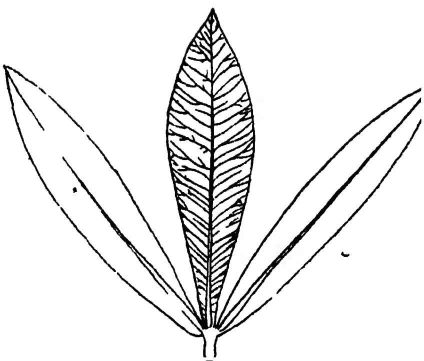
Occasionally one meets with much branched specimens, e.g. Dieterlen 962 from mountain slopes in Basutoland, but as these do not differ otherwise from typical *Rh. discolor* I have refrained from giving them a distinct name.

The following specimens were not classified at the time when they were submitted to me: Dunelm Farm, Fouriesburg, Orange Free State, Potts 3075; Bethlehem, Orange Free State, Potts 2999.

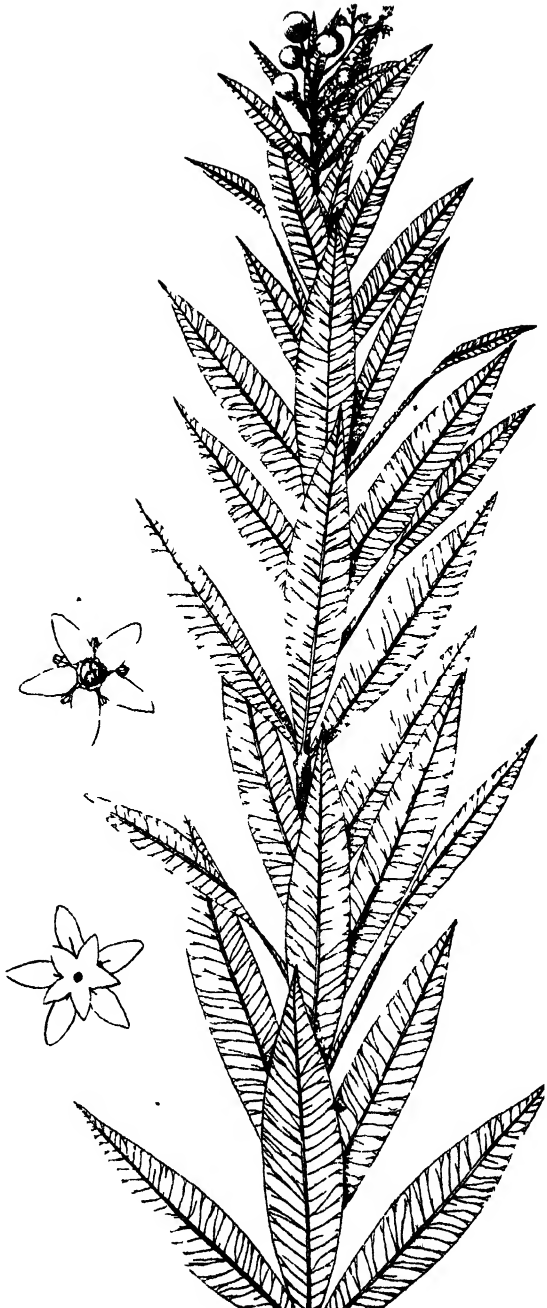
Burtt-Davy records *Rh. discolor* from the following additional Transvaal localities: Spion Kop, Ermelo district, Burtt-Davy 8096; De Emigratie, Ermelo district, Burtt-Davy 4168; Sterkhill, Lydenburg district, Burtt-Davy 481; Rietvley, Machadodorp, Burtt-Davy 7085; near Carolina, Bolus 11756; Spitskop, Pott 4932.

59. **Rh. pondoensis** Schonl. n. sp.

DESCRIPTION: **Frutex parvus caule lignoso efoliato repenti ramis erectis aggregatis basi subteretibus sursum angulatis dense foliosis sparse setaceo-pilosis, pilis saepius curvatis. Folia breviter petiolata, petiolis glabris alatis. Foliola coriacea glabra lineari-lanceolata acutissima vel mucronata basi saepius cuneata, margine integra plana conspicue incrassata, costa utrinque valde prominenti, nervis lateralibus numerosis utrinque prominentibus.**



Rh. pondoensis **Schonl. Wood 3002. Under side**



Rh. pondoensis **Schonl. Wood 3002. (Flowers 3/1.)**

Paniculae laxae ex axillis foliorum superiorum quam folia paullam longiores vel breviores, bracteis lanceolatis acutis. Calycis segmenta triangularia acuta glabra. Petala flava quam calycis segmenta subduplo longiora. Drupa nitida subglobosa vel ovoidea, stilis persistentibus.

Branches 30–40 cm. high. Length of petioles 1¼–3 mm.
Length of terminal leaflets 4–5 cm. Breadth of terminal leaflets 8–10 mm.
Lateral leaflets generally not much shorter than the terminal ones, but slightly narrower.
Length of calyx segments nearly 1 mm.; petals 1¾–2 mm.
Diameter of drupe about 5 mm.

DISTRIBUTION: Only known from Murchison, Pondoland, where it was collected by the late Mr. J. M. Wood (No. 3002 in Herb. S.A. Mus.). The flower examined was noteworthy. It had a normal ovary with three styles, some stamens were rudimentary, though slightly larger than usual in female flowers of *Rhus*, other stamens were evidently normal and functioning.

There can be no doubt that this species is closely allied to *Rh. discolor* E. Mey., but the subsessile perfectly glabrous leaves seem to differentiate it sufficiently from this very variable species.

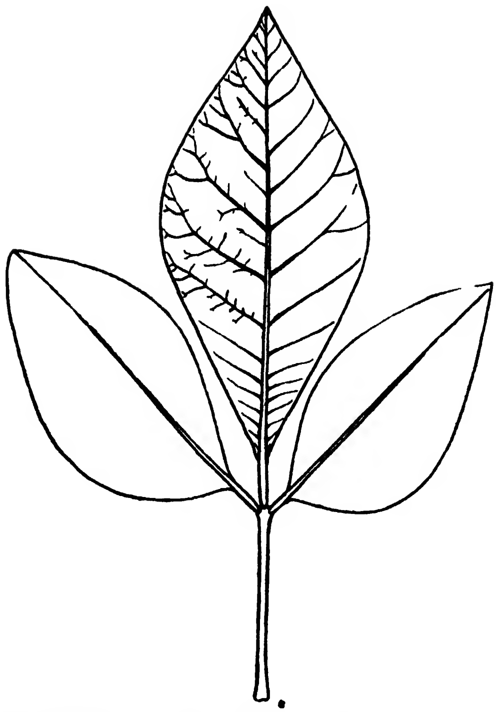
TOMENTOSA group.

60. **Rh. tomentosa** L. spec. 382 (non Mill.); Thunb. Prodr. 52, Fl. Cap. ed. Schultes 266; Sonder l.c. 508; Pappe Sylv. Cap. 13; Engler l.c. 407; Diels l.c. 572, 592, 594, 615, 616, fig. 3; 618, 620.

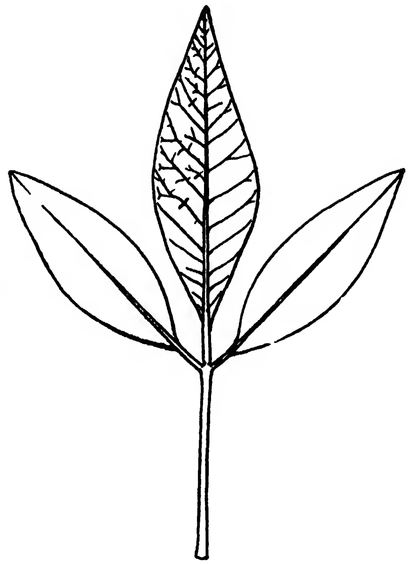
Rh. ellipticum Thunb. Fl. Cap. ed. Schultes 263; *Rh. elliptica* E. Mey. in Drège exsicc.
Rh. bicolor Licht. in Herb. Willd.
Rh. discolor Schrad. hort. Goetting. (ex Sonder).
Rh. Eckloni Schrad. Hort. Goett.
Rh. lobata Poir. in Herb. Berol.
Rh. Plukenetiana E. et Z. in Enum. 1110 (non *Rh. afric.*, etc., Pluk. t. 219, fig. 7).

DESCRIPTION: A shrub or small tree, often 12–15 feet high, branches somewhat patent, branchlets rufous tomentose or pubescent at first, later glabrous, somewhat angular. Leaves petiolate, petioles subterete, slightly furrowed above, usually rather slender. Leaflets coriaceous, dark green or greyish green and glabrous when mature above, covered with dense short greyish or fulvous hairs below, elliptical or ovate, or obovate, acute or acuminate at both ends or obtuse at the apex, sometimes mucronulate, very often petiolulate (petiolules and petioles often reddish); margin flat, entire or very often from above the middle coarsely serrate, teeth acute or obtuse; midrib on upper surface sunk or in the lower part of the leaflets slightly prominent, on lower surface prominent, lateral veins not prominent on upper surface or even sunk, slightly prominent on lower, tertiary veins not visible on either surface or reticulate and plainly visible on upper. Panicles terminal, longer than the leaves, much branched, multiflowered, densely greyish tomentose, bracts linear lanceolate, flowers distinctly pedicelled. Calyx segments ovate, obtuse, villous on the back. Petals oblong, greenish, slightly pilose or pubescent on back. Drupe densely greyish tomentose, compressed and depressed, often somewhat asymmetrical or sometimes subglobose.

Length of petioles 1·5–2 cm.
Length of petiolules up to about 8 mm. in terminal leaflets, shorter or absent in lateral leaflets.
Length of terminal leaflets 5–7 cm., occasionally much smaller.
Breadth of terminal leaflets 1–3·5 cm.
Lateral leaflets generally about two-thirds the size of the terminal leaflets and resembling them.
Length of floral bracts 2–3 mm.; pedicels 1–2 mm.; calyx segments about ¾ mm.; petals 1½ to nearly 2 mm. Greatest diameter of drupe 5–6 mm., smallest 3 mm., height about 4 mm.



Rh. tomentosa L. Zahn (5050). Under side.



Rh. tomentosa L. Zahn (5050). Under side.

DISTRIBUTION: Common amongst shrubs on the hills and mountains of south-west Cape Province (altitude about 200 feet to about 3,000 feet) from Little Namaqualand to George and then in isolated localities to the Transkei (reaching on the south-eastern mountains an altitude of about 5,000 feet and not descending below about 1,500 feet), also in the Wakkerstroom district, Transvaal. It flowers from June to November. Forester Jordaan, Knysna, notes that the flowers have a most disgustingly offensive smell. Sim, in Forest Flora 195, says that it is seldom of timber size or used for other than firewood purposes. Like many other species of *Rhus* it is known as "Taaibosch" from the bark being used as rough cordage.

This species is often represented in eighteenth century herbaria, and was probably one of the earliest introductions to European gardens of South African plants. In Thunberg's herbarium it is found as *Rh. tomentosa* and as *Rh. elliptica*. In Willdenow's herbarium it appears also as *Rh. tomentosa* and *Rh. bicolor* Licht., much reliance having evidently been placed on the shape of the leaflets. *Rh. lobata* Poir. in Herb. Berol. was based on specimens cultivated at Teneriffe. Ecklon and Zeyher in Enum. 1109, besides the type from south-west Cape Province, distinguished three varieties: β *uitenhagensis* (Uitenhage), γ *sylvatica* (Krakakamma), and δ *swellendamensis* (Swellendam). Sonder (l.c. 509) has the type and a var. *petiolaris* in which the leaflets are elliptic oblong, acute or acuminate at both ends, with long petiolules without, however, separating them geographically. Engler (l.c. 408) besides the type has two varieties: β *petiolaris* Sond. and γ *swellendamensis*. In the last the leaflets are oblong elliptical or lanceolate mucronulate, quite entire. He remarks that, through the last, *Rh. tomentosa* comes very close to *Rh. angustifolia*. As I have stated under *Rh. angustifolia*, the question whether this should be united with *Rh. tomentosa* is, with our present knowledge, entirely a matter of opinion. With the large amount of material which I have examined I am unable to separate the

Rh. tomentosa L.   **Fourcade 840.**

species into distinct varieties or even fairly well-defined forms as the distinctive characters relied upon by various authors may be found on the same plant and in widely separated localities. Coppice shoots have often larger leaves than fruiting branches.

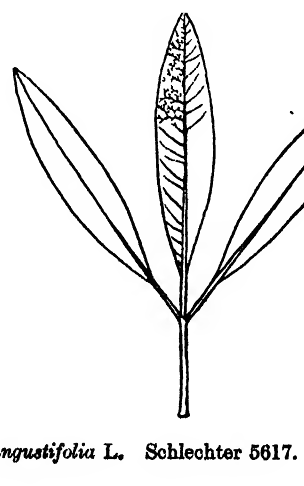
I have in the description of most species not referred to the disk which is usually 5-crenate, though with a tendency to curl so as to become almost 10-crenate. In MacOwan 296 and Schlechter 8634 I found the margin with ten regular blunt teeth, while in *Rh. angustifolia* I found sometimes five acute, divided teeth. I do not know whether these are general reliable distinguishing characters.

Herb. Thunberg; Herb. Willdenow; Burchell 299, 608, 3460, 5491; common on hills near Leeuwfontein, Pearson 3221 (leaflets approaching those of typical *Rh. populifolia* in size and shape); Packhuisberg, Schlechter 8634; Riebeckskasteel, Zwartland, Ecklon 688 (with narrow leaflets); Sevenweekspoort, Phillips 1424; Cape Peninsula: E. & Z. 1110 (type of *Rh. Plukenetiana* E. et Z.), Worsdell 4119, Ecklon 686, Scholl 750, Bowie 193, Diels 39, 85. 1315, Engler 126, 108, 125*a*, Wilms 3120, 3122, Wolley Dod 1393, Bolus 3491, Marloth 11976, Lichtenstein 196 (*Rh. bicolor* Licht.), Drège 353, MacOwan *sine* No. (narrow leaved), Rogers 11243 (narrow leaved); Hottentotshollandberg, Ecklon 526; Stellenbosch, Ecklon 8 and Potts 2136; common in the mountains of Stellenbosch and Worcester, E. & Z. 1109; on the edge of the forests of the Grootvadersbosch, Swellendam, Z. 2232 and E. and Z. 1109 (type of var. *swellendamensis* E. et Z.); Plattekloof, near Fountain, Muir 482; Albertinia, Rogers 16739 (leaves only about half the usual size, panicles very loosely flowered); George, Rogers 4290; edge of the Knysna forest, Jordaan; Melkhoutkraal, Knysna division, Keet 557; flats, Witte Els bosch, Fourcade 840; margin of forest, Ratelsbosch, Fourcade 20; Hofmansbosch, occasional in river bush, Britten 1310; common in sandy soil at the Storms River Pass, about 3 miles from the coast, Zahn (5050); Humansdorp, under 500 feet, Rogers 2901; Van Stadensberg, E. et Z. 1109 (var. *uitenhagensis* E. et Z.); Rust en Vrede, Oudtshoorn, Dyer 84; Boschberg, c. 3,500 feet, MacOwan 296; hills near Grahamstown, MacOwan 12/1276, Britten 1599, Dyer 70, Daly and Sole 469; Hogsback, about 5,000 feet, Rattray 368; Buffels mountain, near Kingwilliamstown, Tyson 1039; Fort Cunynghame, Sim 262; fairly common 18 miles from Tsolo and 23 miles from Maclear, c. 4,700 feet, Dwyer (5085); Slangapies mountains, Wakkerstroom district, Transvaal, Burtt-Davy 1942.

61. **Rh. angustifolia** L. spec. 382; Thunb. Fl. Cap. ed. Schultes 263; Sonder l.c. 507; Engler l.c. 405; Diels l.c. 571, 592, 617, fig. 4 B, 618; Pluk. Alm. t. 219, fig. 6.

Rh. salicinum Herb. Jacq.; *Rh. argentea* Mill. dict. No. 11.

In the Linnaen herbarium, London, No. 21 is called "*angustifolium.*" This is the same plant which Sonder and others call *Rh. angustifolia* L., but No. 27 is also named "*angustifolium*" in the younger Linnaeus' handwriting. This is the same plant which E. et Z. later described as *Rh. stenophylla.* Under *Rh. angustifolium* Linnaeus quotes with his original description Burm. afr. 251, t. 91, fig. 1. This is a bad figure of *Rh. rosmarinifolia* Vahl. Though I have not been able to clear up this matter satisfactorily, I take the species in the sense in which it was taken by Sonder and Engler.



Rh. angustifolia L. Schlechter 5617. Under side.

Rh. angustifolia L. Schlechter 9133. (Flowers 4/1.)

DESCRIPTION: A shrub, usually not more than 4–8 feet high, often with brown branches and with glabrous, pubescent or villous branchlets. Leaves petiolate, petioles subterete. Leaflets coriaceous, petiolulate, narrowly elliptic or lanceolate somewhat tapering at the base, mucronate or rarely emarginate, smooth, shining above, densely covered with short, grey hairs below; margin entire, flat or slightly recurved; midrib sunk above, slightly prominent below, lateral veins distinct but not raised above, often not visible below, tertiary veins sometimes very indistinctly seen on upper surface. Panicles terminal and lateral, longer than the leaves (male longer and denser than female), pubescent or more rarely glabrous. Calyx segments ovate acute. Petals oblong. Drupe densely greyish-pilose, compressed, sometimes slightly oblique.

Length of petioles rather variable, usually less than 1 cm., rarely up to 1·5 cm.
Length of terminal leaflets about 5 cm. Breadth of terminal leaflets 6–10 mm.
Lateral leaflets about four-fifths the length of the terminal leaflets and resembling them.
Petiolules of terminal leaflets 4–5 mm. long, those of the lateral ones slightly shorter.
Length of pedicels about 1 mm.; calyx segments $\frac{3}{4}$–1 mm.; petals about $1\frac{1}{2}$ mm.
Greatest diameter of drupe 4–5 mm.

DISTRIBUTION: Common on slopes of hills (up to 2,000 feet) from Capetown to Caledon, Malmesbury district, Cedarberge, the Pikenierskloof, Hex River, and Swellendam, often on river banks, flowering in spring.

The species exhibits considerable differences in hairiness of young branches, petioles, and panicles, but it cannot be satisfactorily divided into varieties or even fairly well-defined forms. [Engler (l.c. 406) has separated a var. *cinerea* without, however, quoting a type.] There are also variations in the length of the petioles and in the texture and shape of the leaflets, which, however, rarely have a tendency to form short, blunt, toothlike projections. Whether this species should be made a variety of *Rh. tomentosa* is entirely a matter of opinion. As it is circumscribed in its geographical distribution, though overlapped by *Rh. tomentosa*, it is perhaps best to keep it separate, especially as its petioles are always shorter, and even the narrow-leaved forms of *Rh. tomentosa* retain a more oval outline of the leaflets.

Marloth, in Das Kapland, 1908, shows on fig. 14 B the habit of the plant near Palmiet formation. His fig. 24, " Macchia near Stellenbosch ", includes it also.

Herb. Linnaeus (No. 21), London; Herb. Willd., Berlin; Cape Peninsula, Bergius, Ecklon 692, E. et Z. 1092 (also near Stellenbosch and Worcester divisions), Z. 4832, Engler 51, Paterson 68; French Hoek, Phillips 1086; Stellenbosch, Marloth 2822; Bainskloof, Schlechter 9133, 9157; Breede River valley, near Bainskloof, Bolus 2745; Wellington, Marloth 11974c; Caledon, Marloth 11974 *a* and *b*; River-zonder-einde, Schlechter 5617; Hex River valley, Rehmann 2817, Tyson 776; banks of the Buffeljagdsr., Swellendam, Z. 2229; river-bed, Naidouwkloof, Pillans 5341; overhanging stream east side of Pikeniers Pass, Pearson 5225; Hopefield, Malmesbury, Gurke 1566; in stony rivulets, Cedarberge, between Pakhuis and Groenberg, Diels 558 (panicle flexuous). Further, the following specimens in Herb. Kew: Drège 6810*a*, Ecklon 689, Cooper 2168, Burchell 248, 7280, Sieber 217.

62. **Rh. incisa** L.f. suppl. 183; Thunb. Prodr. 52, Fl. Cap. ed. Schultes 267; Sonder l.c. 509; Engler l.c. 408; Diels l.c. 572, 592, 594, 619, 621 and fig. 5 F, G, H, 621.

Rh. obovata Sond. l.c. 508; Engler l.c. 408; Diels 571, 592, 615 and fig. 5, E, F, 621.

Rh. sinuata E. et Z. Enum. 1111 (non Thunb.).

DESCRIPTION: A much branched shrub, 3–10 feet high, with rigid spreading branches and small puberulous branchlets. Leaves petiolate, petioles puberulous or rarely canescent, subterete, slightly canaliculate above. Leaflets (in outline) ovate or obovate-cuneate, rarely obtuse, mucronulate, more or less pinnatifid with obtuse lobes or only with small triangular often obtuse teeth in the upper half or quite entire, above dark green, minutely puberulous or velutinous, below whitish tomentose; margin flat or (in the pinnatifid forms often) revolute, midrib sunk on the upper surface and more or less prominent on the lower, lateral veins not raised or even sunk on the upper surface, more or less prominent on the

lower. Panicles tomentose, terminal on short lateral branches bearing clusters of subsessile flowers, generally only slightly longer than the leaves, sometimes much larger and more luxuriant at the end of elongated branchlets. Calyx segments oblong or ovate, tomentose on the outside; petals oblong-ovate, tomentose on the outside. Drupe dry, subglobose, densely villous, eventually dehiscing (always ?).

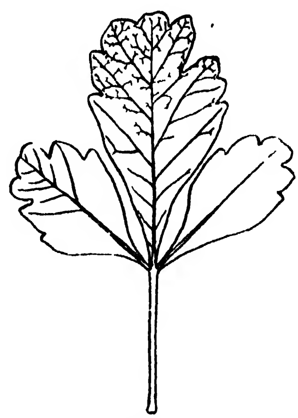
Length of petiole 3–10 mm.
Length of terminal leaflets 1·5 to 2 cm. (rarely up to 3·5 cm.). Breadth of terminal leaflets 1–1·5 cm.
Lateral leaflets generally a little over half the size of the terminal ones and resembling these.
Length of calyx lobes about 1 mm.; petals about 2 mm.
Diameter of drupe 5–7 mm.

DISTRIBUTION: Namaqualand, south-west Cape Province and scattered in open scrub in the coast districts to Komgha, favouring situations near river banks and flowering from July to October.

Rh. incisa and *Rh. obovata* have been kept separate by Ecklon and Zeyher (who wrongly applied the name *Rh. sinuata* to the latter), Sonder, Engler and Diels. It is true that extreme forms seem to be quite distinct on account of the pinnatifid leaflets of the former as contracted with the entire or subentire leaflets of *Rh. obovata*. As long as little material was available, the geographical distribution seemed to confirm this view. Even now forms with pinnatifid leaflets are unknown to me from Riversdale eastwards. On the other hand, plants with more or less entire leaflets occur as far as Namaqualand, e.g. in Drège 6793 *b*, Schlechter 5095, 7854, E. & Z. 1112. Marloth, in "Das Kapland" (1908) 291, stated with reference to *Rh. obovata*, that it is common on mountainous parts near O'okiep and Steinkopf in Namaqualand (where, as he informed me later, stock feeds on it). The amount of dissection of the leaflets may vary considerably on the same plant. Under the circumstances one can only consider these two so-called species as local forms which may be distinguished as follows (but it must be understood that isolated branches of A may be practically indistinguishable from B):—

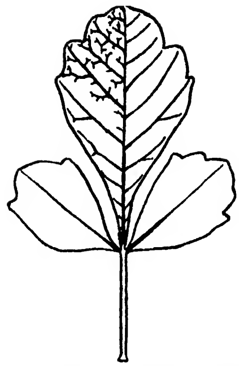
A. *typica*.—Leaflets more or less pinnatifid or nearly entire, often with the lateral veins very prominent on the lower surface, margin usually revolute. Drupe about 5 mm. in diameter. South-west Cape Province (extending to the macchia of the Bokkeveld) and Namaqualand.

Rh. incisa L.f., A. *typica*. Schlechter 4991*a*.



Rh. incisa L.f. Schlechter 7854. Upper side.

B. *obovata*.—Leaflets entire or with small teeth at the apex, lateral veins rarely prominent on the lower surface, margin flat. Drupe 6–7 mm. in diameter. From Riversdale to Komgha. (Engler rightly remarks that in non-flowering branchlets the leaflets are sometimes much longer than usual, more dentate, and the petioles are longer.)



Rh. incisa L.f., B. *obovata*. Britten 1532. Upper side.

A. Herb. Thunberg; Clanwilliam, on the Olifants River and near Brakfontein, Drège; Olifants River, 500–1,000 feet, Schlechter 4991, 8720; Clanwilliam district, Bachmann 711, Schlechter 8720, Diels 279, E. & Z. 1112, Marloth 2618, MacOwan 3311; Namaqualand, Marloth 6715, 6767 (p. pte.), 11153; Bolus 6527, Scully 42, Pearson 6530; mountains above Worcester, Rehmann 2518; between Paarlberg and Paardeberg, Drège 6793*b*; Hex River mountains, Drège 277 (wrongly issued as *Rh. tomentosa* L.); Saron, Schlechter 7854; Simonstown, 1,000–2,000 feet, E. et Z. (this locality requires confirmation).

B. Drège 6794*aa*, Burchell 2194, 3011, 3332, 3499, 3824, 4802 in Herb. Kew; banks of Zoutmelks River, Riversdale, 600 feet, Muir 2473; Gauritz River, Gamtoos River, and Assegaibosch (Albany), E. et Z. 1111; Assegaibosch (Humansdorp), Rogers 2841; between Gamtoos and Kromme Rivers, 118 miles north-west of Humansdorp, Fourcade 413; flats east of Kabeljauws River, near mouth, Fourcade 721; scrub near Gamtoos River, 200 feet, Schlechter 6039; Port Elizabeth, 100 feet, Tyson 2261; mountain sides near Graaff-Reinet, 4,000 feet, Bolus 625; Alicedale, Cruden 40, 78; hills near Bushman and Kareiga River, Z. 2240; between Port Alfred and the Kasouga, not far from the Kasouga mouth, Britten 2260; near Grahamstown, 1,200–2,300 feet, Schonland 574, 3293, MacOwan 34, 164, Britten 1532, 1597, Daly and Sole 303; Buffalo mountain, near Kingwilliamstown, 3,000 feet, Tyson 1038; British Kaffraria, Cooper 42, 421; woods and shrubby places, Prospect farm, near Komgha, Flanagan 292 (in these specimens the leaves are a little longer and relatively narrower than usual and often shortly mucronulate).

63. **Rh. rosmarinifolia** Vahl Symb. III, 30; Willd. sp. I, 1484; Thunb. Fl. Cap. ed. Schultes 262; E. et Z. in Enum. 1088; Sonder l.c. 506; Engler l.c. 404; Diels l.c. 570, 592, 617, fig. 4 E, 618; Burm. Afr. 251, t. 91, fig. 1.

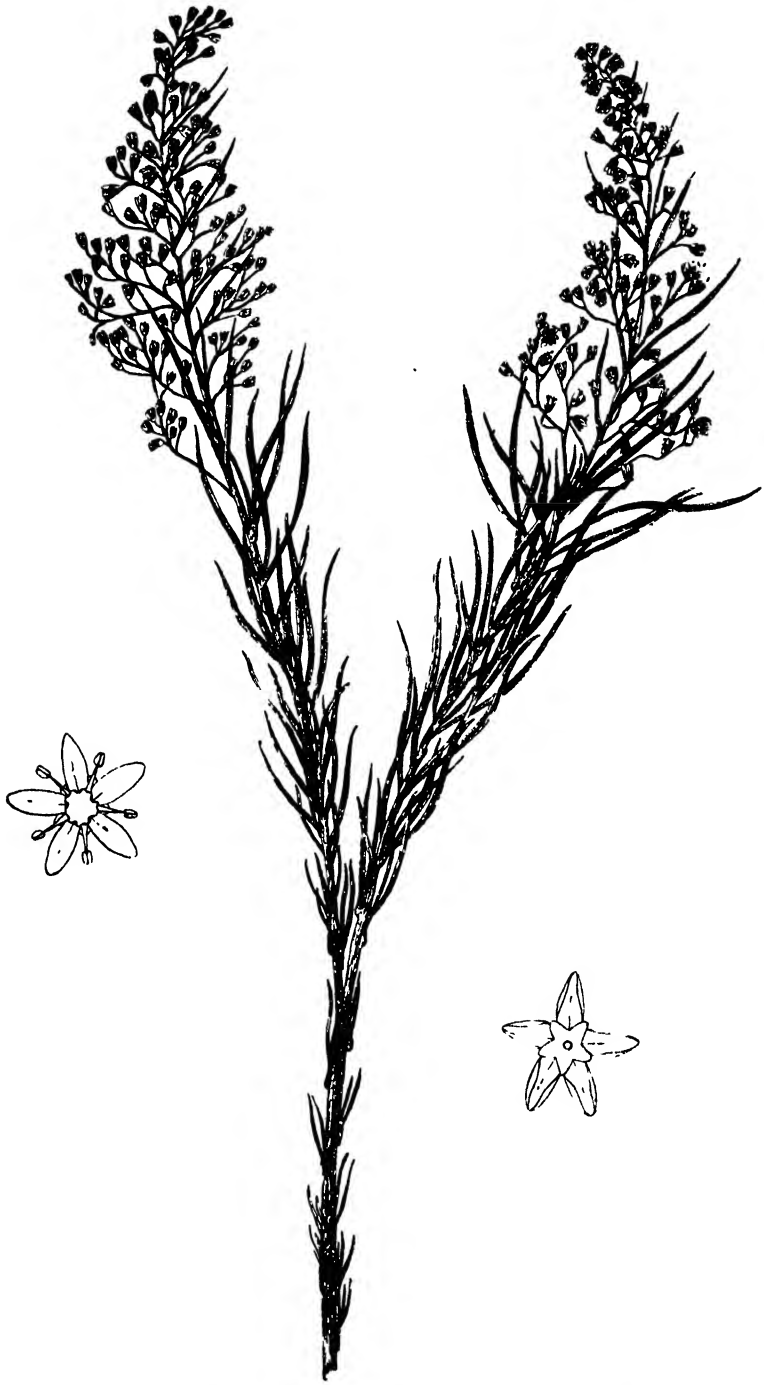
Rh. stenophylla E. et Z. in Enum. 1094; Sonder l.c. 509; Engler l.c. 404; Diels l.c. 571, 592, 594, 617, fig. 4 C, 618.

Rh. lavandulaefolia Presl Bot. Bem. 42.

Rh. angustifolium in Herb. Linnaeus (non Linn.).

Rh. macrocarpa Engl. l.c. 449.

Description: A shrub, 2–4 feet high, with virgate branches and glabrous or puberulous branchlets. Leaves shortly petiolate. Leaflets straight or curved, narrowly linear or linear lanceolate; acute on both ends, sometimes mucronate, glabrous and shining above, whitish-tomentose below, with the exception of the midrib; margin revolute, entire or with one or more sharp teeth; midrib sunk on the upper surface, prominent below, lateral veins deeply sunk on upper surface, rarely visible on lower, tertiary veins not visible. Panicles lateral and terminal, the latter generally longer than the leaves, glabrous, sparsely pilose or pubescent, multiflowered, bracts subulate, flowers shortly pedicellate. Calyx segments ovate acute, subacute or obtuse, sometimes pilose, petals oblong. Drupe large, subglobose, a little compressed, usually whitish or ferruginous tomentose, rarely glabrous.



Rh. rosmarinifolia Vahl. E. and Z. 1088 (flowers enlarged).

Length of petioles generally 5–8 mm.
Length of terminal leaflets 2–5 cm. long, rarely longer.
Breadth of terminal leaflets 1–2 mm., in var. B. up to 5 mm. or even more.
Lateral leaflets generally about four-fifths the size of terminal leaflets and very much like them.
Length of calyx segments about ¾–1 mm.; petals about 2–2¼ mm.
Greatest diameter of drupe 8–10 mm.

DISTRIBUTION: This species, the smallest of the south-west species of *Rhus*, is almost always present on hill-heathland, and extends under similar conditions to Port Elizabeth. (Drège, in Herb. S.A. Mus., is labelled "inter Shiloh et Los Tafelberg Dec. 47". This locality is, without doubt, wrong.)

Flowers mainly in winter.

Diels (l.c. 618) points out that there are only artificial limits drawn between *Rh. rosmarinifolia* Vahl and *Rh. stenophylla* E. et Z. The latter is only a broader leaved variety of the former, as was already suggested by Sonder (l.c. 507). Ecklon and Zeyher in Enum. 1088, divide *Rh. rosmarinifolia* into the following four varieties. They evidently did not realize that their No. 1094, which they described as *Rh. stenophylla*, is very closely allied to it, and placed it between *Rh. rufescens* E. et Z. [=*Rh. discolor*], and the plant which they wrongly called *Rh. tridactyla* Burch. [=*Rh. ecklomana* Sond.].

α capensis.—Leaflets linear, sessile, very long. Amongst shrubs, north and east side of Table Mountain (alt. II), Hottentots Holland Mountain, flowering May, June.

β uitenhagensis.—Leaflets linear, petiolate, very long. In stony places (alt. II) mountain sides of the Zuurberg and Van Stadens (Uitenhage), flowering July.

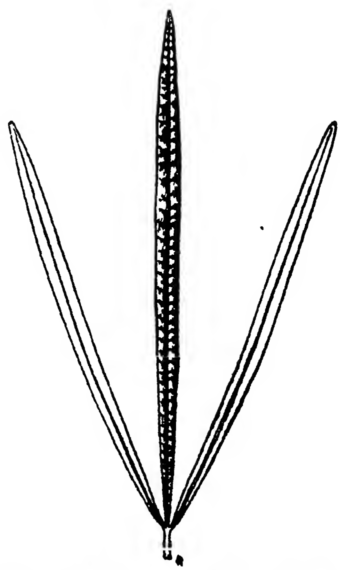
γ caledonica.—Leaflets petioled, linear, very short. In stony places (alt. IV) mountain sides on the Zwarte- and Baviaansberg, near Genadendal (Caledon), flowering June.

δ swellendamensis.—Leaflets shorter, linear-lanceolate. Mountain sides along the Rivier-zonder-einde (alt. II), Swellendam, flowering May. They add: "perhaps a distinct species".

I propose to divide the species into three varieties:—

A. *typica.*—Leaflets narrow linear, acute or mucronate, panicles glabrous.

B. *stenophylla.*—Leaflets linear-lanceolate or oblanceolate, acuminate, mucronate, up to about 7 mm. broad (in the type, E. et Z. 1094, some are 5 mm. broad and 4 cm. long, others on the same branch are only 1½ mm. broad).



Rh. rosmarinifolia Vahl., B. *stenophylla.* 5/2. Paterson 2269. Upper side.

C. *brevifolia*.—Leaflets elliptico-lanceolate, acute or paucidentate at the top, c. 15 mm. long, 2·5–4 mm. broad.

A sharp distinction between these varieties is not possible, and it may be that some relatively broad leaved specimens are hybrids between *Rh. rosmarinifolia* and *Rh. angustifolia* L.

Schlechter 7872 (Saron, 600 feet, flowering June) was looked upon by the collector as a hybrid between *Rh. rosmarinifolia* and *Rh. dissecta.*

A. *typica*.—Herb, Thunberg fol. *a*; Herb. Willdenow; on the sides of Table Mountain and Hottentots Holland Mountains (var. *capensis* E. et Z.); other specimens from the Cape Peninsula: Ecklon 1, Schlechter 769, 1227, Z. 4279, Wolley Dod 1095, 2501, Cooper 2492, Pappe, Prior, Ecklon 6099; Piquetberg, Drège 6812; Dal Josaphat, Tyson 847; stony places in the third altitude on the Zwartebergen and the Baviaans River, near Genadendal, E, et Z. 1088 (var. *caledonica* E. et Z.); stony places on the Van Stadens mountain, Z. 2227 (this shades into B as do also the following:) Port Elizabeth golf course, Cruden 417, Kemsley 167; near Redhouse, Paterson 2269; Burchell 451, 873, 943, 6374, 8374, 8535 in Herb. Kew.

Rh. lavandulaefolia Presl Bot. Bem. 42 (in Herb. Berol.) is a form with long narrow leaflets which are strongly curved. Rehmann 1346, from Stinkwater, Capetown, must be referred to it. The leaflets reach a length of 5–6 cm., while they are barely 1 mm. broad.

B. *stenophylla*.—Herb. Thunberg fol. *β* and *γ*; Herb. Linneaus No. 27; stony places east side of Table Mountain, E. et Z. 1094 (type of *Rh. stenophylla* E. et Z.); Lions Head, Wilms 3127; above the blockhouse, Capetown, Wolley Dod 36; Prince Alfreds Pass, 2,400 feet, Fourcade 1281; stony places at Van Stadens mountain, MacOwan 1030; Port Elizabeth, J. L. Drège; Burchell 4470, 4528, 6766, Z. 331 in Herb. Kew.

In Sieber 216 (Cape Peninsula?) the breadth of leaves is extraordinarily variable, one is 1 cm. broad. Some specimens in Herb. S.A. Mus. distributed by Ecklon and Zeyher under 1094 as *Rh. stenophylla δ swellendamensis* have rather long petioles (up to 1 cm.), and the shape and size of the leaves varies also considerably.

C. *brevifolia*.—Mountain sides near Rivier-zonder-einde, Swellendam, E. and Z. *sine* No. in Herb. S.A. Mus. (var. *swellendamensis* E. et Z.); Caledon, ? in Herb. S.A. Mus.

Rh. macrocarpa Engl. l.c. 449; Diels l.c. 591, 592, 517, fig. 40.

This is only known from Burchell 6756, 6758, collected on the Zoutmelksrivier, near Riversdale. In the Kew Herbarium it was placed by Sonder under *Rh. stenophylla* E. & Z. It is only distinguished from *Rh. rosmarinifolia* Vahl C *brevifolia* by perfectly glabrous drupes, but already Diels (l.c. 592) has pointed out that the haircovering of the fruit in *Rh. rosmarinifolia* is not constant. He found on a specimen collected by Mundt and Maire (on the Cape Peninsula?) that the young carpels and consequently the fruitwall were perfectly glabrous. The absence of a haircovering on the fruit alone can, therefore, be scarcely looked upon as a specific difference.

POPULIFOLIA group.

64. **Rh. populifolia** E. Mey. in Drège exsicc.; Sonder l.c. 508; Engler l.c. 407; Diels l.c. 571, 592, 622.

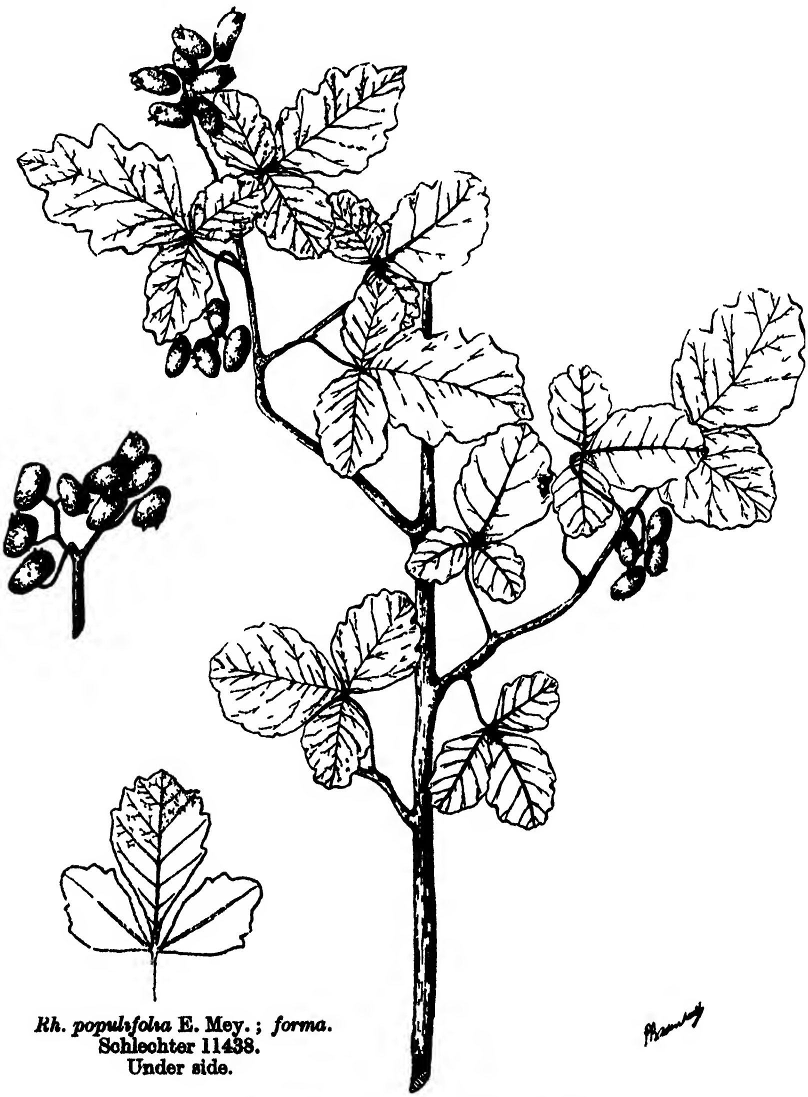
Rh. Steingroeveri Engl. Bot. Jahrb. XXIV, 500; Diels l.c. 572, 592, 621, fig. 5 A.

Description: A much branched shrub, 5-10 feet high, with glabrous or puberulous branchlets. Leaves petiolate, petioles slightly furrowed above and slightly winged. Leaflets subcoriaceous, often very shortly petiolulate, rhombeo-suborbiculate, triangulate or subovate, cuneate at the base, obtuse at the apex, dark green, subglabrous above, greyish or greyish-red tomentose below; margin flat, usually crenato-dentate or entire; midrib and lateral veins yellowish and not prominent (or even sunk) above, prominent below, tertiary veins few and distinct below. Panicles puberulous, lateral and terminal, shorter than the leaves with pedicelled flowers. Calyx segments ovate subacute, petals oblong. Drupe tricuspidate, obliquely depressed and compressed, sometimes slightly verrucose, puberulous or glabrous when ripe.

Length of petiole about 1 cm.
Length of terminal leaflets usually 1·3–3·5 cm. Breadth of terminal leaflets 2–3 cm.
Lateral leaflets about two-thirds the size of the terminal leaflets.
Length of calyx segments ½–¾ mm.; petals about 1·5 mm.
Greatest diameter of fruit 5–6 mm.

DISTRIBUTION: Namaqualand, Bushmanland, South-West Protectorate.

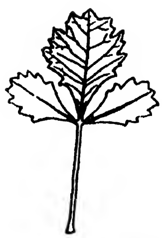
Already Diels (l.c. 572) has stated that *Rh. Steingroeveri* Engl. can only be distinguished from *Rh. populifolia* E. Mey. by smaller size of the leaflets and sometimes by the shape of the leaflets. I do not see any reason, therefore, to keep up Engler's species. The leaflets sometimes approach those of the form of *Rh. incisa*, which is known as *Rh. obovata* Sond. Sonder says that the fruit is tipped by the styles, but it is more than that. The styles enlarge slightly and form small spines as in a few other South African species of *Rhus* (the fruits distributed with Pearson 4465 and 4695 do not belong here and not even to the genus *Rhus*). Flowers June, July.



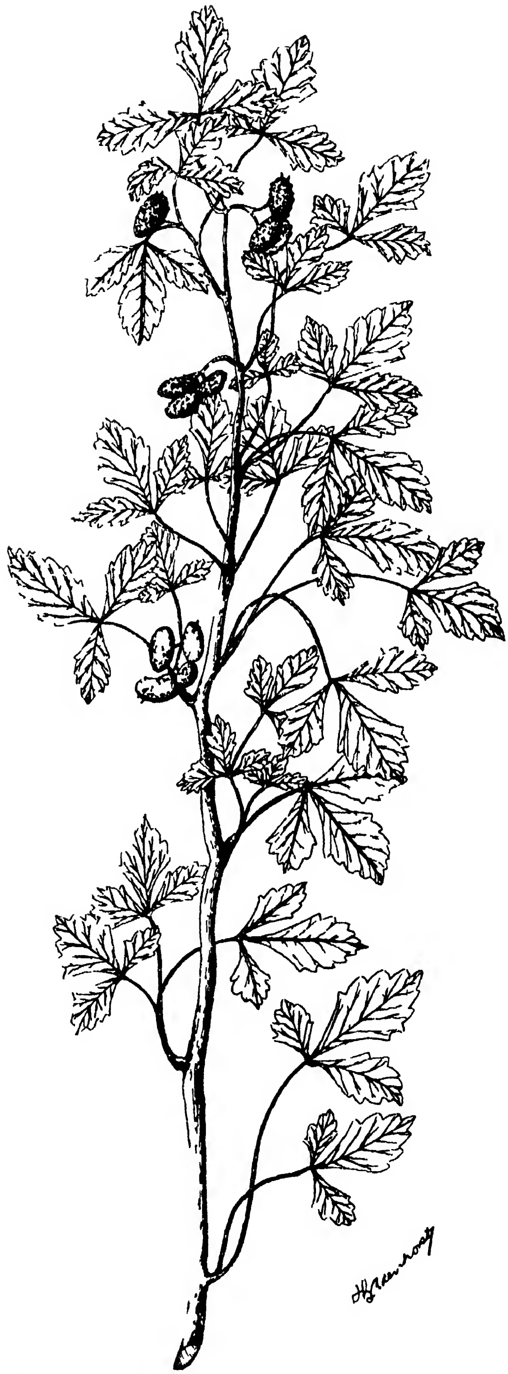
Rh. populifolia E. Mey.; *forma*.
Schlechter 11438.
Under side.

Rh. populifolia E. Mey. Phillips 8963.

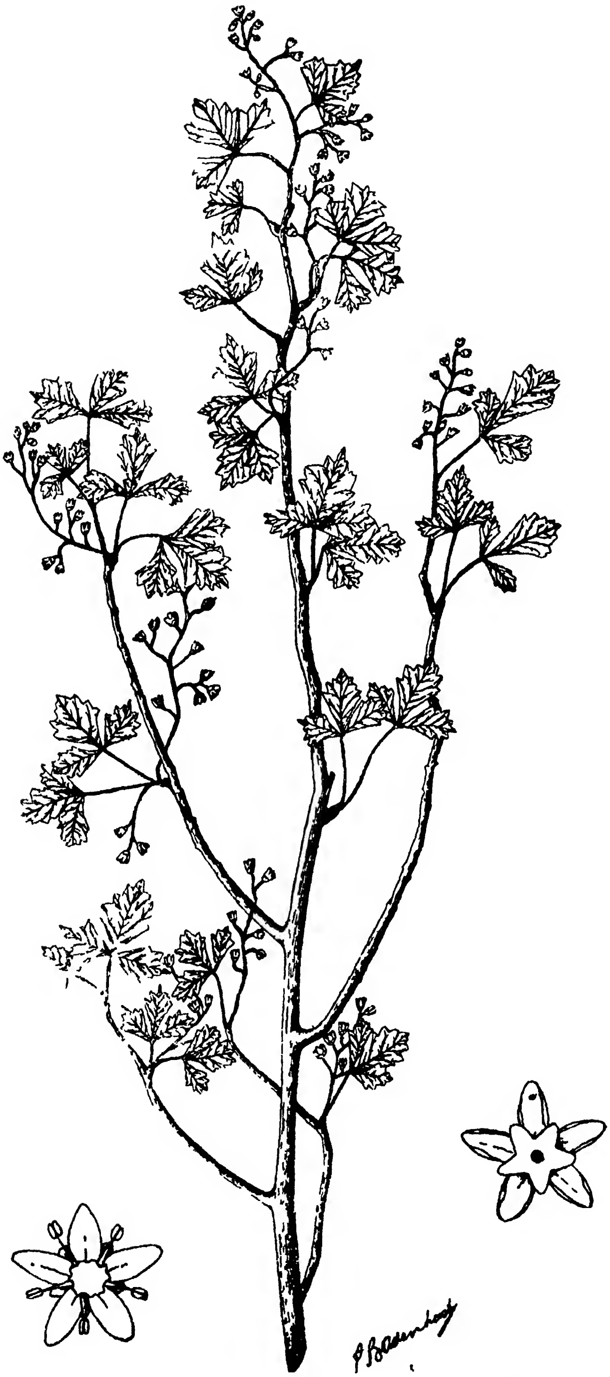
Mouth of Orange River, Drège (in Herb. Kew); rocky places on the Orange River, first alt., Drège 3032; Aus, Steingroever 56, 51 (in Herb. Berol.) (type of *Rh. Steingroeveri* Engl.); amongst rocks near spring at Karibis, Warmbad district, 900 m., Marloth 4793; hills near Wolveton, Schlechter 11438 (too



Rh. dissecta Thunb. Mader.
Upper side.



Rh. dissecta Thunb., A. *obovata*. female. Tyson 635 (female).
(Flowers 4/1.)



Rh. dissecta **Thunb., A. *obovata*. Tyson 635 (male, flowers enlarged).**

scrappy); Steinkopf, Namaqualand, Marloth 6767 (p. pte.); Namaqualand and Bushmanland, between Steinkopf and the Orange River, Phillips 1568; Bushmanland, 2,700 feet, Pearson 4695; sand at foot of Gesellschaftsbank, 2,700 feet, forming thickets, Pearson 4695; Great Namaqualand, Pearson 4017, 5263, 4465, 6164; South-West Protectorate (in Herb. Berol.), in the coast desert and on hills up to 3,000 feet: Hermann 20, Range 416, 833 (in one branch leaflets narrowly ovate up to 5 cm. long and 3·2 cm. broad), 1080, 1171, Schulze 100.

65. **Rh. dissecta** Thunb. Fl. Cap., ed. Schultes 267; Sonder l.c. 509; Engler l.c., Diels l.c. 572, 592, 622, fig. 5 B, C, D.

Rh. argentea E. et Z. in Enum. 1127.

DESCRIPTION: A shrub, 5–6 feet high, with terete, glabrous, reddish brown, sometimes filiform branchlets. Leaves petiolate, petioles often reddish, slender, subterete. Leaflets coriaceous, glabrous and dark green above, greyish tomentose (except on midrib and veins) below, more or less obovate in upper part, strongly contracted and narrowly obcuneate in lower part; margin slightly thickened and often slightly revolute, entire in lower part, sharply cut in upper part with teeth generally triangular, mucronate, or leaflets pinnatifid; midrib and lateral veins yellowish and barely raised on the upper surface, pale reddish and prominent on the lower, tertiary veins not visible. Panicles glabrous, loose and few-flowered, terminal on short lateral branches, bracts subulate, acute, flowers pedicelled. Calyx segments oblong-triangular, obtuse, petals oblong. Drupe glabrous, oblique, depressed and compressed, shining, more or less verrucose, tricuspidate.

Length of petioles 1·2–2·4 cm.
Length of terminal leaflets 3–4·5 cm. Breadth of terminal leaflets 5–12 mm.
Lateral leaflets about two-thirds the size of the terminal leaflets.
Length of pedicels 1–2½ mm.; calyx segments ¾–1 mm.; petals 1¾–2¼ mm.
Greatest diameter of drupe 6–8 mm.

DISTRIBUTION: From north of the Olifants River through the Clanwilliam district, Malmesbury district, Hex River valley. Flowers in winter and spring.

This species is nearest to *Rh. populifolia* E. Mey. as shown by its drupe. The venation of leaves in both is also very similar. Sonder (l.c. 509) distinguishes two varieties, to which the following names may be given, though a sharp line cannot be drawn between them:—

A. *obovata*.—"Leaflets obovate or suborbiculate, cuneate, incised dentate" (*Rh. argentea* E. et Z. 1127; *Rh. dissecta* E. Mey. in Drège exsicc.).

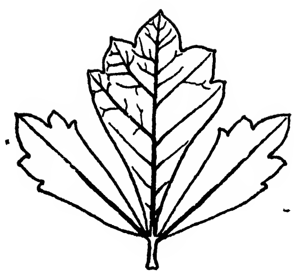
B. *pinnatifida*.—"Leaflets pinnatifid, lobes lanceolate, acute" (*Rh. dissecta* Thunb., E. et Z. 1128; E. Mey. *a* and *f*).

A. *obovata*.—Burchell 992, 7460, in Herb. Kew; Giftberg, common, 2,000 feet, Phillips 7529; banks of Olifants River, 400 feet, Schlechter 5027*a*, Stephens 7123; Clanwilliam, Mader, Schlechter 1637, Diels 280; stony places above Wupperthal, MacOwan 3273; swampy ground, mountain sides near Brakfontein, Clanwilliam, E. & Z. 1127 ("Corynthebosses") (this is the type of *Rh. argentea* E. et Z. and includes their var. *brevifolia*, in which the leaflets are a little smaller and not so sharply cut as in the type); between Pikenierskloof and Clanwilliam, Z. 232; Cedarberge, near Groenberg, c. 2,500 feet, Diels 860; Piquetberg, Edwards 193, Bolus 13530; near Groenekloof, Bolus 4265; Kradouw Krantz, Pillans 5,300; Klitzkop, near Darling, Bachmann 608, 1564; Moorreesburg, Bachmann 1562; Waterboerskraal, Malmesbury, Bachmann 1563; hills near Malmesbury, Schlechter 167; near Hopefield, Bachmann 1802; Hex River valley, at the foot of the mountains, Engler 273, Rehmann 2821, Tyson 635.

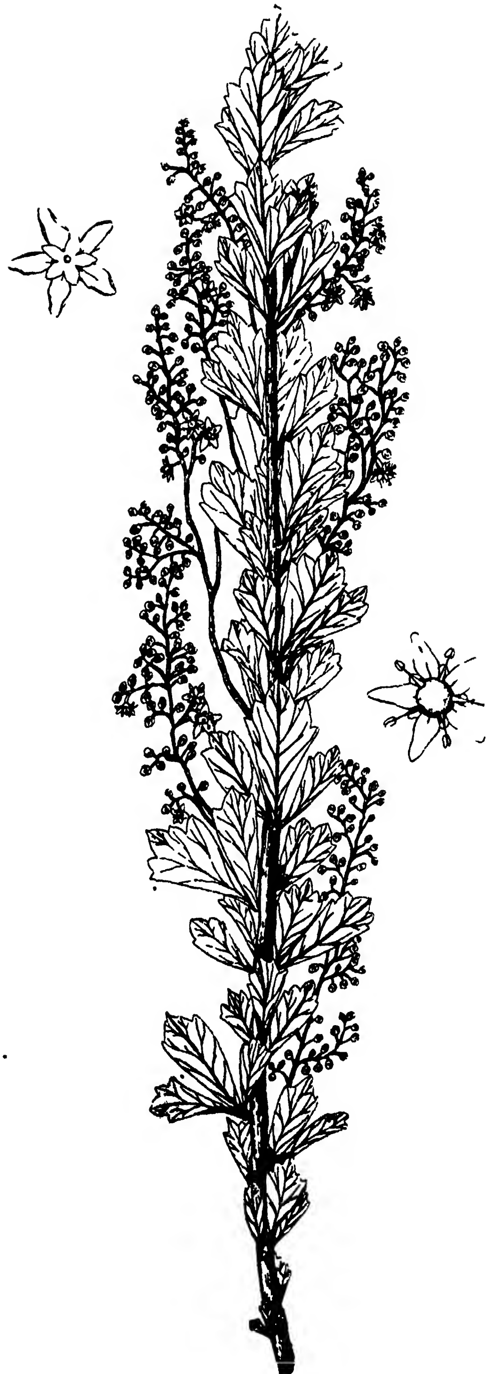
B. *pinnatifida*.—Herb. Thunberg; Groenekloof, Pappe 10; Nieuwekloof, 1,500 feet, Schlechter 7504; Saron, 1,000 feet, Schlechter 7861; ib., 600 feet, Schlechter 7872 (Schlechter has marked this "*Rh. rosmarinifolia* X *dissecta*").

66. **Rh. cuneifolia** Thunb. Prodr. 52, Fl. Cap. ed. Schultes 267; Sonder l.c. 512; Engler l.c. 419; Diels l.c. 576, 637, fig. 8 A, B, C.

DESCRIPTION: An erect shrub with terete or slightly angulate, sometimes purplish, minutely puberulous branchlets. Leaves shortly petiolate or subsessile. Leaflets coriaceous, glabrous, obcuneate, obovate-cuneate or subrhomboid, margin thickened and slightly



Rh. cuneifolia Thunb Schlechter 4824
Under side



***Rh. cuneifolia* Thunb. Herb. MacOwan 1795. (Flowers enlarged.)**

revolute, entire except in upper part which is grossly dentate, teeth acute or acuminate, sometimes mucronulate; midrib and lateral veins slightly prominent on the upper surface, more so on the lower, tertiary veins not visible. Panicles axillary and terminal, pilose, the female about as long as the leaves, the male much longer, rather loose, flowers pedicelled. Calyx segments ovate, subacute, petals oblong. Drupe obliquely ovoid, depressed and compressed, shining, tricuspidate.

Length of petioles ½–3 mm.
Length of terminal leaflets 1·2–1·5 cm. Breadth of terminal leaflets 8–10 mm.
Lateral leaflets one-half to two-thirds the length of the terminal leaflets and resembling them, but often asymmetrical.
Length of pedicels about 1 mm.; calyx segments barely ½ mm.; petals about 1¼ mm.
Greatest diameter of drupe about 6 mm.

DISTRIBUTION: Caledon district, Stellenbosch district, and Clanwilliam, in rocky situations. Marloth (Das Kapland, p. 261) also quotes it from the Guarri formation, Montagu, Oudtshoorn, Ladismith, north side of the Zwartebergen. Flowers in spring.

Diels (l.c. 577) says that there are transitions between this and *Rh. scytophylla* E. & Z., but this applies only to the shape of the leaflets. I am inclined to place it close to *Rh. dissecta* Thunb., with which it agrees in the fruit and the venation of the leaflets.

Herb. Thunberg; Burchell 8197, 8244, 8288, Pearson 7782 in Herb. Kew; Zwarteberg, Caledon, Ecklon 37 (*Rh. africana* Ecklon non Mill.); Hottentotshollandsbergen, near Grietjesgat and Steenbrass River (Stellenbosch) in Langehoogde, and near Bontjeskraal (Caledon), E. and Z. 1131; near Caledon warmbaths, 1,000 feet, MacOwan 2795; Howhoek, c. 1,500 feet, Bolus 9191; Sir Lowry's Pass, Schlechter 4824; near Clanwilliam, Leipoldt in Herb. MacOwan 2795.

INDEX.

(Names of species marked with an asterisk have been retained by the author.)

The following genera have been mentioned in the text:—

The Genus Psoralea Linn.

By HELENA M. L. FORBES, Natal Herbarium, Durban.

The South African species of the genus *Psoralea* were last monographed by Harvey in Harvey and Sonder's "Flora Capensis" (Vol. II) and since then much fresh material has accumulated in the South African Herbaria. As the genus is a fairly typical representative of the family, especially in the South-Western portion of the Cape Province, it was suggested to the writer that the local material be brought up to date. The Curators of the Bolus Herbarium, the National Herbarium, and the herbaria of the Albany and South African Museums very kindly placed their respective collections at the disposal of the writer. Archdeacon F. A. Rogers also allowed use to be made of his private collection. The writer is also indebted to Dr. I. B. Pole Evans, C.M.G., for granting facilities to undertake the work, and to Dr. E. P. Phillips for assistance and criticism.

The genus *Psoralea* comprises a large group of shrubs and herbs belonging to the sub-order *Papilionaceae* of the family *Leguminosae*. The species, numbering about 124, are found throughout the tropical and sub-tropical parts of the world, and of these, 49 occur in South Africa. Most of the species occur in the south-western districts of the Cape Province, but extend through the south-eastern districts into the Transkei and Natal. The majority of the Transvaal species are found in the northern spurs of the Drakensbergen, a few in the western districts. With one or two exceptions, the genus is not represented in the Karoo proper, nor in the north-western districts of the Cape Province, and but few species have been recorded from Namaqualand and South West Africa.

The habit of the species varies considerably; some attain a height of 15 feet, while others are low shrubs or diffuse herbs, while at least one species forms a dense cushion-like growth. A characteristic feature of the genus is the presence of resinous glands on practically every part of the plant. With the exception of *P. biovulata*, all the species are uni-ovulate. The flowers are blue, purple, or rarely yellow, and the majority of the species have sweetly-scented flowers.

PSORALEA (Linn.).

From "*The Genera of South African Flowering Plants*," by E. P. Phillips.

Calyx gland-dotted, sub-equally lobed, or the lowest segment the largest; the upper segments often connate. *Standard* ovate or orbicular, clawed, with inflexed sides; wings oblong, sub-falcate; keel incurved, obtuse, shorter than the standard. *Stamens* diadelphous; the vexillary stamen free or more or less connate with the others; anthers uniform or the alternate fixed higher. *Ovary* sessile or shortly stalked, 1-ovuled, in 1 species 2-ovuled; style filiform or dilated at the base, incurved above; stigma terminal. *Pod* ovate, indehiscent, concealed in the calyx. *Seed* without an appendage; funicle very short.

Herbs, shrubs or undershrubs; leaves gland-dotted, digitately 3 to many-foliate, pinnate or 1-foliate; stipules embracing the branches, scarcely adnate to the petiole; inflorescence a head, spike or raceme, axillary or terminal, or flowers fascicled or rarely solitary; bracts 2–3; bracteoles 0.

KEY TO SPECIES.

1. Leaves reduced or apparently absent, or leaflets filiform or linear to linear obovate, not much broadened from the base upwards.......... 2

Leaflets obovate, oblanceolate or elliptic, broader at the apex than at the base.......... 22

2. Leaves much reduced, never 5 mm. long.......... 3

Leaflets long-linear, sometimes reduced to a single leaflet, but usually over 1 cm. long.......... 4

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Calyx glabrous within; ovary 2-ovuled.......... 2 *biovulata.*

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Leaflets more than 3.......... 8

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Leaves trifoliate, rarely unifoliate.......... 9

9. Vexillum glandular.......... 6 *capitata.*

Vexillum not glandular.......... 10

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14. Upper leaflets unifoliolate; stems laxly leafy.......... 8 *oligophylla.*

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Leaves on petioles up to 1 cm. in length.......... 18 *tenuissima.*

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Leaves with 2–5 pairs of leaflets; flowers blue.......... 21

21. Pedicels up to 2·5 cm. long, with connate bracts seldom exceeding 1 mm. in length.......... 20 *pinnata.*

Pedicels up to 4 cm. long, with connate bracts up to 4 mm. long.......... 21 *affinis.*

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Inflorescence axillary, racemose, calyx-tube and lobes marked with purple striae.......... 24 *Bowieana.*

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Leaves pellucid-dotted, canescent.......... 26 *argenta.*

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48. Leaves, etc., canescent; mucro recurved.............................. 48 *striata.*
Pubescence yellowish; leaves mucronulate............................... 49 *Royffei*

1. **P. aphylla** Linn.

A tall erect virgate shrub up to 30 metres with drooping branches. *Stems* glabrescent, glandular, canescent when young. *Leaves* unifoliate, 5–17 mm. long, linear, acute; present only on very young stems, their place on older stems being taken by ovate acute bracts up to 5 mm. long. *Stipules* adnate to the base of the petiole, up to 3 mm. long, filiform, acute. *Flowers* axillary, 1–3 subtended by a bract. *Pedicels* bracteolate about the middle, with scattered black hairs on upper portion. *Bracts* up to 5 mm. long, connate, bi-lobed, acute, glandular, pilose. *Calyx-tube* 2·5–6 mm. long, 6–10 mm. in diameter, 10 nerved, glandular, glabrous to nigro-hirsute; lobes linear-lanceolate to lanceolate-ovate, acute, glandular, ciliate, glabrous or laxly nigro-hirsute; shortly pilose on the inner surface; upper and lateral lobes 2–6 mm. long, 1–2 mm. broad; slightly sub-falcate; lowest lobe 4–12 mm. long, 1·5–8 mm. broad. *Vexillum* 7–14 mm. long, 6–15 mm. broad, obovate or sub-orbicular, geniculate, shading from white to deep blue; claw 1–4 mm. long, with two small appendages at the apex; alae pure white, 7–12 mm. long, 2–8 mm. broad, with a linear claw 2–5 mm. long; carina with a deep blue blotch at the apex, 5–9 mm. long, 3–6 mm. broad, with a linear claw 2–7 mm. long. *Ovary* glabrous; style 6–9 mm. long, glabrous.

Flowers: June–January.

CAPE.—Clanwilliam district: Klavoer, *Wolley Dod* 298; Piquetberg district: Piquetberg, *Edwards* 248; Worcester district: Mitchell's Pass, *Bolus* 2607; Tulbagh district: Waterfall, *Ecklon* and *Zeyher*; *Rogers* 17395; Cape district: Table Mountain, *MacOwan* 924; *Bolus*; *Ecklon* and *Zeyher* 1530; *Galpin* 3695, *Ecklon* and *Zeyher*, *Forbes*

140; Wynberg, *Wolley Dod* 21; Wynberg and Kalk Bay, *Bolus* 2607; Camps Bay, *Rogers* 3022 without precise locality, *Wolley Dod* 2257: Caledon district: Steenbras, *Moss* and *Rogers* 1540; *Rogers* 10510; Zwart Berg, *Galpin* 3694; Mossel River, *Potts* 1586; Riversdale District: Riversdale, *Schlechter* 1881.

2. **P. biovulata** Bolus.

A small slender shrub. *Stems* ·3–·6 mm. long, slender, thinly canescent when young, becoming glabrescent. *Leaves* up to 6 mm. long, resembling scales, adpressed, exstipulate, rigid, few, linear-acuminate or subulate, glabrescent, ciliate, with incurved margins. *Flowers* terminal, 1–3 together on short pedicels or subsessile. *Pedicels* bracteate. *Calyx-tube* up to 1·5 mm. long, 3 mm. in diameter, pilose with short silky white hairs, 10-nerved; lobes unequal, lanceolate, acuminate, ciliate, minutely glandular, glabrous on the inner surface; 2 lobes 1–1·5 mm. long, about 5 mm. broad; 3 lobes 2–3 mm. long, 0·5–1 mm. broad. *Vexillum* 4 mm. long, 5-6 mm. broad, broadly obovate, with a short claw 1 mm. long; alae 4–5 mm. long, 2 mm. broad, with a linear claw 1·5 mm. long; carina 3–3·5 mm. long, 2 mm. broad, with a linear claw 1·5 mm. long. *Ovary* pilose, 2 ovuled; style 3 mm. long, pilose.

Flowered: October.

Cape.—Bredasdorp district: Mount Elim, *Bolus* 6902.

3. **P. restioides** E. and Z.

A slender trailing suffruticose. *Stems* up to ·6 m. long, glabrous, glandular, striate. *Leaves* unifoliolate, rarely trifoliolate, petiolate, stipulate; petioles up to 1·5 cm. long; leaflets 0·5–3 cm. long, scarcely 1 mm. broad, subsessile, filiform, mucronulate, glabrous, glandular. *Stipules* adnate to the base of the petiole; up to 1·1 cm. long, stem-clasping, glandular. *Flowers* solitary, axillary, pedicellate. *Pedicels* up to 1 cm. long, bracteolate about the middle. *Bracts* membraneous, tri-lobed, glandular, ciliate; 1 lobe short; 2 lobes up to 6 mm. long, acute, filiform, sub-falcate. *Calyx-tube* 2–4 mm. long, 4–7 mm. in diameter, glabrous, glandular; lobes unequal, lanceolate, ciliate, glandular, glabrous, shortly nigro-hirsute on the inner surface; upper and lateral lobes 1 4 mm. long, 0·4–1·5 mm. broad; lowest lobe 4-6 mm. long, 1-2 mm. broad, subulate. *Vexillum* 5-7 mm. long, 5-8 mm. broad, obovate, with a linear claw 1·5–3 mm. long; alae 5–6·5 mm. long, 1·5–2·5 mm. broad, with a linear claw 2–3 mm. long; carina 3–4 mm. long, 1 2 mm. broad, with a linear claw 2·5–4 mm. long. *Ovary* glabrous; style 3-4 mm. long, glabrous.

Flowered: August December. Flowers: Violet-blue.

Cape.—Clanwilliam district: Vogelgat, *Schlechter* 9529; Cape district: Muizenberg, *Bolus* 4271, *Wolley Dod* 2566; Table Mountain, *Bolus* 4504, *Wolley Dod* 795; Caledon district: Klein River, *Ecklon* and *Zeyher*, Hermanus, *Burtt-Davy*, *Bolus* 9841; Bredasdorp district: Elim, *Bolus* 6901, *Bodkin*; Riversdale district: Riversdale, *Rogers* 4394, *Muir* 794, Langeberg, *Schlechter* 2153; Mossel Bay district: Mossel Bay, *Potts*.

4. **P. fascicularis** D.C.

Plants suffruticose. *Stems* up to 6 metres, slender, diffuse or ascending, glabrous. *Leaves* trifoliolate, sometimes unifoliolate; leaflets 1–3 cm. long, linear-lanceolate, apex very acute; petioles up to 2·5 cm. long. *Stipules* adnate to the petiole, stem-clasping, up to 3 cm. long; points of stipules 1–3 cm. long, subulate, acute. *Flowers* axillary, solitary, or several together. *Pedicels* up to 6 mm. long, axillary, solitary or several together. *Calyx-tube* 2 mm. long, 5 mm. in diameter, glandular, glabrous; lobes linear-lanceolate, acute, glabrous, ciliate, nigro-hirsute on the inner surface; upper and lateral lobes 2–3 mm. long, up to 1 mm. broad; lowest lobe 5 mm. long, 1 mm. broad. *Vexillum* 5–6 mm. long, 4–5 mm. broad, obovate with a linear claw 2 mm. long; carina 3–3·5 mm. long, 1·5 mm. broad, with a claw 2 mm. long; alae 5 mm. long, 1·5–2 mm. broad, with a claw 2 mm. long. *Ovary* glabrous; style 3–4 mm. long, glabrous.

Flowers: November–January.

Cape.—Stellenbosch district: Hottentots Holland near Somerset West, *Ecklon* and *Zeyher*; Cape district: Newlands, *Forbes* 89, Orange Kloof Farm, *Wolley Dod* 3166.

5. **P. Gueinzii** Harv.

Plant suffruticose. *Stems* 3–6 metres, diffuse, villose, becoming glabrescent. *Leaves* unifoliolate, 1–2·5 cm. long, up to 4 mm. broad, lanceolate, very acute, sub-sessile. *Stipules* ovate, acute, striate, persistent. *Flowers* axillary, pedicellate. *Pedicels* short, about 3 mm. long, bi-bracteolate. *Bracts* about 3 mm. long, ovate, acute, ciliate. *Calyx-tube* 2 mm. long 6 mm. in diameter, sparsely glandular and villous; lobes lanceolate, acute, ciliate, glands small, pilose on the inner surface; upper and lateral lobes 3–3·5 mm. long, about 1 mm. broad, lowest lobe 5 mm. long. *Vexillum* obovate, 1 cm. long, 8 mm. broad, with a narrow channelled claw 2 mm. long; alae 7 mm. long, 2 mm. broad, with a linear claw 2 mm. long; carina 5 mm. long, 3 mm. broad, with a linear claw 3 mm. long. *Ovary* glabrous; style 6 mm. long, glabrous.

CAPE.—Stellenbosch district: Hottentots Holland, *Ecklon* and *Zeyher*.

6. **P. capitata** L.f.

Plant shrubby. *Stems* slender, up to 12 metres long, sparsely leafy, striate, glandular, glabrescent. Leaves uni or-trifoliolate; upper leaves usually unifoliolate; petioles variable, up to 2·5 cm. long; leaflets 1–8 cm. long, up to 4 mm. broad, linear to linear-lanceolate, acute, nigro-punctate, glabrescent. *Stipules* adnate to the base of the petiole, up to 7 mm. long, subulate, acute. *Inflorescence* spicate or compressed into an aggregated terminal head subtended by one or more unifoliolate leaflets with simple acute glandular pilose adnate stipules up to 1 cm. long, or stipules simple or connate. *Flowers* pedicellate. *Pedicels* about 2 mm. long, bracteate. *Calyx-tube* 1·5–2 mm. long, 3–5 mm. in diameter, glandular, glabrous to villoso-hirsute; lobes lanceolate, acute, ciliate, glandular, glabrous to villoso-hirsute without, pilose to nigro-hirsute within; upper and lateral lobes 1-3 mm. long, 0·5–1 mm. broad; lowest lobe 2·5–5 mm. long, 0·5–1 mm. broad. *Vexillum* 5–7·5 mm. long, 4–6 mm. broad, obovate, glandular, with a claw 0·5–2 mm. long; alae 4·5–7 mm. long, 1·5–2 mm. broad, with a linear claw 1–2 mm. long, carina 4–6 mm. long, 1·5–2 cm. broad, with a linear claw 1-3 mm. long. *Ovary* glabrous; style 3–7 mm. long, glabrous.

Flowers: November–April.

CAPE.—Caledon district: Twenty-four Rivers, *Zeyher*; Tulbagh district: Waterfall, *Zeyher*; Cape district: Kenilworth, *Bolus* 3285; Knysna district: Knysna, *Zeyher*, Plettenberg Bay, *Leipoldt*; Uitenhage district: Witte Klip, *Bolus*, Zwartskops River, *Zeyher* 2386; Albany district: Grahamstown, *Glass*, *Southey*; Komgha district: Cape Morgan, *Flanagan* 2370.

LOCALITIES UNKNOWN.—*Zeyher* 4945, *Tyson* 3049, *MacOwan* 2068.

7. **P. uncinata** E. and Z.

Plant small, 3–6 metres high; branching chiefly from the root. *Stems* erect, canescent, becoming glabrous, striate; glands becoming conspicuous when the stems are glabrous. *Leaves* trifoliolate, at equidistant nodes 3 cm. apart, shortly petiolate, stipulate; petioles up to 5 mm. long; leaflets up to 3·2 cm. long and 4 mm. broad, linear-oblong, a few lower ones cuneate-oblong, acuminate, uncinate, with scattered hairs and glands, the glands forming a continuous band round the margins. *Stipules* adnate to the base of the petiole, striate, canescent, glabrescent, with two lanceolate acute points up to 7 mm. *Inflorescence* terminal and axillary, in dense sub-globose heads. *Peduncles* very short, up to 6 mm. long. *Flowers* sessile or sub-sessile. *Calyx-tube* 3–4 mm. long, 6–8 mm. in diameter, canescent, distinctly 10-nerved, sparsely glandular; lobes linear-lanceolate, acute, glandular, canescent, ciliate, with the inner surface glabrous or shortly and thinly pilose; upper and lateral lobes 4–6 mm. long, 1–2·5 mm. broad; lowest lobe 6 mm. long, 2–3 mm. broad. *Vexillum* 6–8 mm. long, 4–6 broad, obovate with a linear claw 1–3 mm. long; alae 5–7 mm. long, 1–2 mm. broad, with a claw 3–4 mm. long; carina 3–4 mm. long, 1·5–2 mm. broad, with a claw 3–4 mm. long. *Ovary* pilose; style glabrous.

Flowers: November–January.

CAPE.—Piquetberg district: Pentonville, *Edwards* 249; Tulbagh district: near Tulbagh, *Zeyher* 1554, *Rogers* 17341, Wintershoekberg, *Zeyher*; Cape district: Capetown, *Guthrie*; Caledon district: Vier-en-Twintig Rivier, *Zeyher*; Beaufort West district: Nieuwe Kloof, *Schlechter* 9038.

8. **P. oligophylla** E. and Z.

A tall slender virgate shrub. *Stems* glabrous, glandular, striate, sparsely leafy. *Leaves* uni- or trifoliolate, petiolate, stipulate; petioles up to 1 cm. long; leaflets up to 4·5 cm. and 4 mm. broad, linear to linear-lanceolate, acute, glabrous, glandular. *Stipules* minute, subulate. *Flowers* axillary 1–3 together. *Pedicels* up to 3 cm. long, bibracteolate near the apex. *Bracts* 2–4 mm. long, with acute glabrous ciliate glandular lobes. *Calyx-tube* 2–4 mm. long, 6–9 mm. in diameter, glandular, glabrous, 10-nerved; lobes 1–5 mm. long, 1–2 mm. broad, slightly unequal, lanceolate-ovate, acute, slightly sub-falcate, glabrous, glandular, ciliate, shortly pilose on the inner surface. *Vexillum* 6–11 mm. long, 7–12 mm. broad, sub-orbicular, geniculate; claw 1–4 mm. long, with two slight appendages at the apex; alae 0·6–1 cm. long, 2–5·5 mm. broad, with a linear claw 2-5 cm. long; carina 4–7·5 mm. long, 2·5–5·5 mm. broad, with a linear claw 3–6 mm. long. *Ovary* glabrous; style 3–8 mm. long, glabrous. *Pod*, when fully developed, about 6 mm. long and 3 mm. broad; seed about 4·5 mm. long, 2 mm. broad, brown.

A tall shrub 5-6 feet high, growing usually in moist places.

Flowers: Blue.

CAPE.—Van Rhynsdorp district: Giftberg, *Phillips* 3236, 7488; Ceres district: Onderbokkeveld, *Ecklon* and *Zeyher*, Koude Bokkeveld, *Schlechter*, Matroosberg, *Phillips* 1944; Worcester district: Hex River Valley, *Tyson* 1908, *Rehmann* 1533, 1534; Riversdale district: Riversdale, *Muir* 81; George district: Outeniqua Mountains, *Hops* 52, George, *Schlechter* 2227; Humansdorp district: near Humansdorp, *Schonland* 3086, Witte Els Bosch, *Fourcade* 827; Port Elizabeth district: Hankey, *Sim* 173, *Forest Dept. Herb.* 3957; Bathurst district: Bathurst, *Rogers* 3516; Albany district: Grahamstown, Featherstone's Kloof, *Bolus* 1935, Atherstone, *Rogers* 3316, Howison's Poort, *Galpin* 141, *Glass*, *Barber*, *Galpin* 336, *Zeyher* 2383, *Ecklon* and *Zeyher*, *MacOwan* 448, Asylum, *Daly* and *Sole* 137, Hofman's Bosch, *Britten* 1327, near Sanatorium, Zuurberg, *Schonland* 3185, Cold Spring, *Rogers* 5635, 27312, 27514; Queenstown district: Queenstown, *Galpin* 8107, Cathcart Shiloh, *Baur* 862; Kingwilliamstown district: Kingwilliamstown, *Sim* 2301; Komgha district: Komgha, *Flanagan* 556, 3410: Tembuland, Xalanga, *Bolus* 8858.

Gt. Bushmanland, Vogelklip, *Pearson* and *Pillans* 5932, Leliefontein, *Pearson* 6344.

LOCALITIES UNKNOWN.—*Rogers* 17584, *Schlechter* 10186, *Britten* 140.

9. **P. verucosa** Willd.

Plant shrubby. *Stems* erect, glandular striate, tomentulose. *Leaves* trifoliolate, petiolate, stipulate; petioles up to 1·5 cm. long; leaflets up to 4 cm. long and 4 mm. broad, linear-lanceolate, acute, glabrous, nigro-punctate. *Stipules* up to 3 mm. long, subulate, acute. *Flowers* axillary, 1–3 together. *Pedicels* up to 2·2 cm. long, bracteolate. Bracts about 1 mm. long. *Calyx-tube* 3 mm. long, 5 9 mm. in diameter, 10-nerved, glandular, glabrous; lobes ovate, acuminate, glabrous, glandular, ciliate, shortly pilose on the inner surface. *Vexillum* 0·5–1 cm. long, 0·5–1·2 cm. broad, sub-orbicular, geniculate; claw 0·5–2 mm. long, with two slight appendages at the apex; alae 5–9 mm. long, 2–5 mm. broad, with a linear claw 3–5 mm. long; carina 3–5 mm. long, 2-4 mm. broad, with a linear claw 1–6 mm. long. *Ovary* glabrous; style 2–8 mm. long, glabrous.

CAPE.—Worcester district: Worcester, *Ecklon* and *Zeyher* 1520; Knysna district: Wittesdrift, Plettenberg Bay, *Zeyher*; Humansdorp district: Humansdorp, Storms River, *Schlechter* 5971; Uitenhage district: Zwartkops River, *MacOwan* 725, *Ecklon* and *Zeyher* 1521, *Zeyher* 2379; Port Elizabeth district: Walmer, *Paterson* 829, Braakens River, *Burchell* 4218.

10. **P. polyphylla** E. and Z.

Plant shrubby, pubescent, glabrous when older. *Stems* erect, leafy, branched. *Leaves* trifoliolate, sub-sessile, stipulate; leaflets 1·1–1·5 cm. long, 2–4 mm. broad, linear to linear-oblong, mucronate, glands immersed; lateral leaflets unequal sided. *Stipules* small, ovate, acuminate, not persistent. *Flowers* axillary, 2–3 together. *Pedicels* very short. *Calyx-tube* nigro-villous and veined; upper and lateral lobes subulate, the lowest ovate-lanceolate, longer than the rest.

Flowered: July.

Cape.—Uitenhage district: Krakakamma, *Ecklon* and *Zeyher* 1536. Description taken partly from "Flora Capensis," as there were no complete flowers on the material seen.

11. **P. Mundtiana** E. and Z.

Plant shrubby, up to ·6 m. high. *Stems* erect, pubescent, leafy. *Leaves* trifoliolate, petiolate, stipulate; petioles about 5 mm. long, glabrescent; leaflets 1·5–2·5 cm. long, 4–6 mm. broad, broadly linear to linear-oblong, tapering at the base, recurved mucronate, pellucid dotted. *Stipules* about 5 mm. long and 1·5 mm. broad, ovate, acute, pubescent, scarious, striate. *Flowers* axillary, 2–3 together. *Pedicels* short. *Calyx-tube* 3 mm. long, 8 mm. in diameter, glandular, villous; lobes lanceolate, acute, villous, glandular, ciliate, pilose on the inner surface; upper and lateral lobes 5–7 mm. long, 1–1·5 mm. broad; lowest lobe 8 mm. long, 2 mm. broad. *Vexillum* 6 mm. long, 5 mm. broad, obovate, with a narrow channelled claw 1·5 mm. long; alae 6 mm. long, 1·5 mm. broad, with a linear claw 2 mm. long; carina 3 mm. long, 2 mm. broad, with a linear claw 2 mm. long. *Ovary* and style missing in the specimen examined.

Flowered: December.

Cape.—Swellendam district: Swellendam, *Ecklon* and *Zeyher* 1537.

12. **P. candicans** E. and Z.

Plant shrubby, virgate, densely or thinly canescent, glabrescent. *Stems* erect, laxly leafy. *Leaves* trifoliolate, shortly petiolate, stipulate; petioles about 2 mm. long; leaflets 1·5 cm. long, 0·65 cm. broad, linear to linear-oblong, obtuse, recurved mucronate, nigro-punctate; a few of the lower leaflets cuneate. *Stipules* small, up to 3 mm. long, adnate to the base of the petiole, subulate, acute, glandular. *Inflorescence* axillary, 1–3 flowers on common peduncle. *Peduncles* up to 1·7 cm. long; pedicels about 4 mm. long. *Calyx-tube* 1·5–3 mm. long, 4–6 mm. in diameter, canescent, distinctly 10-nerved, with small often inconspicuous glands; lobes linear-lanceolate, acute, pilose, glandular, glabrous on the inner surface; upper and lateral lobes 2–4 mm. long, about 1 mm. broad, slightly sub-falcate; lowest lobe 4–6 mm. long, about 1 mm. broad. *Vexillum* 3–5 mm. long, 3–5 mm. broad, obovate, with a linear claw 1–2 mm. broad; alae 3–5 mm. long, 1–2 mm. broad, with a claw 1·5–2 mm. long; carina 2–3 mm. long, 1–2 mm. broad, with a claw 2 mm. long. *Ovary* pilose; style 2–3 mm. long, glabrous.

Flowered: September–May.

Cape.—Worcester district: Hex River, *Bolus* 8005; Caledon Division: *Zeyher*, Elandskop, *Schlechter* 9757, Ruggens near Zuurberg, *Galpin* 3960, near Genadendal, *Galpin* 3959, *Bolus* 7381; Swellendam district: Swellendam, Grootvaders Bosch, *Zeyher* 1539; Uitenhage district: Zwartkop River, *Zeyher* 2731; Albany district: Redhouse, Grahamstown, *Paterson* 238; Somerset East district: Bruntzeshoogte, *MacOwan*.

Without Locality: *Zeyher* 2373.

13. **P. axillaris** L.

Plant shrubby. *Stems* erect, glabrous, glandular, striate. *Leaves* trifoliolate, stipulate, petiolate ; leaflets 1–2·8 cm. long, 3–8 mm. broad, linear to linear-oblong, tapering at the base, obtuse, mucronulate, nigro-punctate, glabrous. *Stipules* about 3 mm. long, subulate. *Flowers* axillary, usually solitary. *Pedicels* up to 2 cm. long, bracteolate near the apex. *Calyx-tube* 2–4 mm. long, 0·6–1 cm. in diameter, thickly nigro-punctate, glabrous ; lobes 1–3 mm. long, 1 2 mm. broad, slightly unequal, ovate, obtuse, nigro-punctate, glabrous shortly ciliate, pilose on the inner surface. *Verillum* 0·8–1 cm. long, 0·8–1·1 cm. broad, sub-orbicular, geniculate ; claw channelled, 1·5 2 mm. long, with two slight appendages above ; alae 0·7–1 cm. long, 3–5 mm. broad, with a claw 3–5 mm. long ; carina 5–6 mm. long, 4–5 mm. broad, with a linear claw 5 6 mm. long. *Ovary* glabrous ; style 6–9 mm. long, glabrous.

CAPE.—Tulbagh district : Tulbagh, *Burchell* 1033 ; Knysna district : Knysna, *Duthie* 767, Plettenberg Bay, *Zeyher* ; Uitenhage district : Witteklip, *MacOwan* 1044 ; Port Elizabeth district : Port Elizabeth, *Kemsley* 247, *Paterson* 829, Van Stadens River, *Bolus.*

14. **P. triantha** E. Mey.

A slender shrub up to 4 ft. *Stems* erect, tomentulose. *Leaves* trifoliolate, petiolate, stipulate ; petioles about 6 mm. long ; leaflets 0·5 2·5 cm. long, up to 6 mm. broad, linear, spathulate, recurved mucronate, thick, glabrous, nigro-punctate. *Stipules* about 2·5 mm. long, acuminate. *Flowers* axillary, crowded. *Pedicels* 0·5 1 cm. long. *Calyx-tube* 2 mm. long, 4–6 mm. in diameter, pubescent, grandular ; lobes lanceolate, pubescent, pilose on the inner surface ; upper and lateral lobes 1 2 mm. long, 0·5-1 mm. broad. *Vexillum* 4–8 mm. long, 4–6·5 mm. broad, obovate, with a linear claw 1·5-2 cm. long ; alae 4–6 mm. long, 1·5-2·5 mm. broad, with a linear claw 2 3 mm. long ; carina 2·5 3 mm. long, 1·5–2 mm. broad, with a linear claw 2·5–3 mm. long. *Ovary* glabrous or thinly pilose ; style 3–4 mm. long, filiform.

Flowers : November–February.

CAPE.—Clanwilliam district : Clanwilliam, *Leipoldt* 632 ; Tulbagh district : Witsenberg, *Zeyher* 446 ; Cape district : Blaauwberg, *Drege ;* Paarl district French Hoek, *Schlechter* 10268, Paarl, *Schlechter* 202 ; Uitenhage district : Zwartkop River, *Zeyher* 263.

15. **P. Bolusii** Forbes n. sp.

Plant shrubby, small. *Stems* erect, leafy, glandular, striate ; young stems densely albotomentose becoming glabrescent. *Leaves* trifoliolate, petiolate, stipulate ; petioles about 7 mm. long ; leaflets 1–2·5 cm. long, about 4 mm. broad, linear to linear-oblong, nigro-punctate, densely albo-hirsute becoming almost glabrous, recurved mucronate. *Stipules* adnate to the base of the petiole, up to 5 mm. long, subulate, acute. *Flowers* axillary, in groups of 3, sub-sessile. *Calyx-tube* 3 mm. long, 5 mm. in diameter, glandular, hirsute ; lobes unequal, hirsute, long-ciliate, glandular, pilose on the inner surface ; two upper lobes 2 mm. long, about 0·25 mm. broad, linear, acute ; lateral lobes 3·5–4 mm. long, about 0·5 mm. broad, linear, acute ; lowest lobe 6 mm. long, 1·5 mm. broad, lanceolate, acute. *Vexillum* 5·5 mm. long, 5·5 mm. broad, obovate, with a channelled claw 3 mm. long ; alae 5·5 mm. long, 2·5 mm. broad, with a linear claw 2·5 mm. long ; carina 3 mm. long, 1·5 mm. broad, with a linear claw 3 mm. long ; *Ovary* thinly pilose ; style 3 mm. long, filiform.

Flowered : October.

CAPE.—Piquetberg district : Piquetberg, *Bolus.*

16. **P. oreophila** Schltr.

A very small slender herb, branching from the root. *Stems* decumbent, up to 3 metres long, filiform, subterete, with scattered leaves. *Leaves* trifoliolate, petiolate, stipulate ; petioles slender ; leaflets linear, acute, narrowing at the base. *Stipules* 4–5 mm. long, equalling or about half the length of the petiole, connate, linear-lanceolate, acute, glabrous.

Flowers axillary, solitary. *Pedicels* nearly equalling the leaves, bracteolate near the middle. *Bracts* up to 5 mm. long. *Calyx-tube* 2 mm. long, 4·5–5 mm. in diameter, glabrous, glandular; lobes linear-lanceolate, acute, glabrous, glandular, very shortly ciliate, glabrous on the inner surface; upper and lateral lobes 3–5 mm. long, 1–1·25 mm. broad; lowest lobe 5·5-6 mm. long, 1·5 mm. broad. *Vexillum* 5·5–6 mm. long, 6–8 mm. broad, sub-orbicular with a channelled claw 1·5–2 cm. long; alae 4·5–5 mm. long, 2 mm. broad, with a linear claw 2–2·5 mm. long; carina 3 mm. long, 2 mm. broad, with a linear claw 2–2·5 mm. long. *Ovary* glabrous; style 3·5 mm. long, glabrous.

Flowered: January. Flowers: Deep blue.

CAPE.—Caledon district: Sir Lowry's Pass, *Schlechter* 7233.

17. **P. glaucina** Harv.

Plant suffruticose, diffuse. *Stems* slender, glabrous. *Leaves* trifoliolate, petiolate, stipulate; petioles 0·7–2 cm. long; leaflets 0·9–2 cm. long, up to 2 mm. broad, linear-lanceolate, acute, tapering at the base, glabrous, glandular. *Flowers* axillary, 1–3 together. *Pedicels* 1–1·5 cm. long, bracteolate near the middle. *Bracts* 2-2·5 mm. long, tri-lobed, ciliate, acute. *Calyx-tube* 2 mm. long, 5 mm. in diameter, glandular, glabrous, 10-nerved; lobes lanceolate, acute, glandular, glabrous, with almost reticulate veining, shortly ciliate, very shortly pilose on the inner surface; upper and lateral lobes 1·5–2 mm. long, up to 1 mm. broad; lowest lobe 3 mm. long, 1 mm. broad, *Vexillum* 4 mm. long, 4 mm. broad, obovate, with a channelled claw 1 mm. long; alae 3 mm. long, 1·5 mm. broad, with a linear claw 2 mm. long; carina 2 mm. long, 1 mm. broad, with a linear claw 3 mm. long. *Ovary* glabrous; style 3 mm. long, glabrous.

CAPE.– Doornhoogte, *Ecklon* and *Zeyher*.

18. **P. tenuissima** E. Mey.

Plant slender, trailing. *Stems* up to 6 metres long, glabrous. *Leaves* trifoliolate, petiolate, stipulate; petioles up to 9 mm. long; leaflets up to 2·5 cm. long, 1·5 mm. broad, narrow, linear, acute, nigro-punctate, glabrous, sub-sessile. *Stipules* up to 2 mm. long, subulate, acute, glandular. *Flowers* axillary, solitary. *Pedicels* up to 3 cm. long, bracteolate, near the apex. *Calyx-tube* 2 mm. long, 5–6 mm. in diameter, glandular, glabrous; lobes acute, lanceolate, glabrous, ciliate, glandular, pilose on the inner surface; upper and lateral 2–3 mm. long, 1–1·3 mm. broad; lowest lobe 3–4 mm. long, up to 1 5 mm. broad. *Vexillum* 6–8 mm. long, 6–8 mm. broad, obovate, geniculate, with a channelled claw 1–2 mm. long; alae 6–8 mm. long, 2–3 mm. broad, with a linear claw 1·5–2 mm. long; carina 5 mm. long, 2 mm. broad, with a linear claw 2–3 mm. long. *Ovary* glabrous; style 9 mm. long, glabrous.

CAPE.—Tulbagh district: Tulbagh, *Schlechter* 7476; Swellendam district: Wageboom's River, *Schlechter* 10701.

19. **P. odoratissima** Jacq.

Plant shrubby, at least 18 metres high. *Stems* striate, glandular, sparsely pilose. *Leaves* imparipinnate, petiolate, stipulate; petioles 5–8 mm. long; leaflets 5–7 pairs, 0·7–2·2 cm. long, about 1·5 mm. broad, linear-lanceolate, acute, glandular; young leaves laxly clothed with fairly long white hairs. *Stipules* about 4 mm. long and 2 mm. broad, lanceolate-ovate, acute, ciliate. *Flowers* axillary, 1–3 or more together. *Pedicels* up to 1·5 cm. long. *Calyx-tube* 3–5 mm. long, 7–5 mm. in diameter, sparsely pilose with long white hairs, glandular; lobes, lanceolate, acute, slightly sub-falcate, ciliate, shortly pilose on the inner surface; upper and lateral lobes 4 mm. long, 2 mm. broad; lowest lobe 1 cm. long, 2·5 mm. broad. *Vexillum* 1 cm. long, 1·1 cm. broad, sub-orbicular, geniculate, with a channelled claw 3 mm. long; alae 1 cm. long, 5 mm. broad, with a linear claw 5 mm. long; carina 6 mm. long, 4 mm. broad, with a linear claw 5·5 mm. long. *Ovary* glabrous; style 6 mm. long, glabrous.

Flowers: Pure white, very fragrant.

Flowered at Kirstenbosch, October–November, 1923, 1924. Original locality unknown.

20. **P. pinnata** Linn.

Plant a tall much branched woody shrub up to 30 metres high. *Stems* striate, virgate, glandular, glabrous or pubescent. *Leaves* impar-pinnate, petiolate, stipulate; leaflets up to 5 cm. long and 3 mm. broad, linear to linear-lanceolate, acute, glandular, sometimes recurved at the apex. *Stipules* free, about 5 mm. long, lanceolate to ovate-lanceolate, acute, pubescent. *Flowers* axillary, 1 3 or several together. *Pedicels* sub-sessile or up to 2·5 cm. long, bracteolate near the apex. *Bracts* 1–3 mm. long, connate, pilose, with acute ciliate lobes. *Calyx-tube* 2 6 mm. long, 0·4-1·3 cm. in diameter, villous or glabrous, glandular; lobes lanceolate, ovate, acute, glabrous or villous, glandular, ciliate, pilose on the inner surface; upper and lateral lobes 2–7 mm. long, 0·5-3 mm. broad; lowest lobe 0·4–1 cm. long, 2–4 mm. broad. *Vexillum* 0·4–1·4 cm. long, 0·4–1·5 cm. broad, sub-orbicular or broadly obovate, geniculate; claw channelled 1–4 mm. long, with or without the two small appendages at the apex of the claw; alae 0·4–1·2 cm. long, 1·5–6 mm. broad, with a linear claw 1-5 mm. long; carina 2·5–8 mm. long, 1·5-7 mm. broad, with a linear claw 2–7 mm. long. *Ovary* glabrous; style 0·3 1 cm. long. *Seed* 4 mm. long, 2 mm. broad, reddishbrown.

Flowers: Pale to deep blue. This species has a wider distribution than any other native species and is in bloom almost the whole year.

CAPE.—Clanwilliam district: Clanwilliam, *Rogers* 16798, Olifants River, *Leipoldt*; Tulbagh district: *Scott* and *Elliot*, Winterhoek, *Phillips* 1729: Cape district: Devils Peak, *Ecklon* and *Zeyher* 1519, Table Mountain, *Forbes* 139, Newlands, *Forbes* 91, Wynberg Mountain, *Wolley Dod* 22; Stellenbosch district: Stellenbosch, *Ecklon* and *Zeyher* 1515; Paarl district: French Hoek, *Schlechter* 9263, 10268, *Phillips* 1089; Caledon district: Caledon *Zeyher*, *Bolus*; Swellendam district: Swellendam, *Ecklon* and *Zeyher* 1518; Riversdale district: Riversdale, *Muir* 79, Aasvogelberg, *Muir* 1850, Ladismith, Seven Weeks Poort, *Phillips* 1432; Mossel Bay district: Mossel Bay, *Rogers* 4165, *Potts*; George district *Mitchell* (*Bolus Herb.* 16090), *Rogers* 4281, near Langekloof, *Zeyher* 1517, Robertson Pass, Outeniqua Mountains, *Hops* 53, Garcia's Pass, *Phillips*; Knysna district: Knysna, Main Forest, *Schonland* 3600, Plettenberg Bay, *Smart* (*Rogers* 15457); Kingwilliamstown district: Zitzikamma Mountains, *Britten* 1079; Humansdorp district: Humansdorp, *Schonland* 3018, Witte Els Bosch, *Fourcade* 892, 923, 924, *Muir* 1250, Assegai Bosch, *Rogers* 2834, Slang River, *Phillips* 3441; Uitenhage district: Uitenhage, *Ecklon* and *Zeyher* 305, *Schonland* 3730, *Britten* 3027, Van Staadens, *Paterson* 734; Albany district: Grahamstown, *Zeyher* 903, 2380, *Rogers*, *Schonland*, Signal Hill, *Dale* and *Cherry* 883, Coldspring, *Gower*; Queenstown district: Katberg, *Schonland* 4298; Fort Beaufort district: Hogsback, *Rattray* 83, *Stayner* 11, Hoffman's Bosch, *Britten* 1185, near Kat River, *Ecklon* and *Zeyher* 1514; Cathcart district: Cathcart, *Cotterrell* 164, *Galpin* 7360; Komgha district: near Kei Mouth, *Flanagan* 178; Kentani district: Kentani, *Pegler* 255; Umtata district: Umtata, *Schlechter* 6337; Beaufort West district: Murraysburg, *Bolus* 220.

TRANSVAAL.—Lydenburg district: Pilgrims Rest, *Rogers* 23110, Lydenburg, *Wilmer*; Zoutpansberg district: Zoutpansberg, Rietfontein, *Leendertz* 808; Woodbush, *Jenkins* 7194; Barberton district: Barberton, *Galpin* 401, Elandshoek, *Rogers* 448.

SWAZILAND.—*Stewart* 3687.

NATAL.—Drakensberg, Polela, *Evans* 714; Karkloof, *Dimmock-Brown* 333; Maritzburg, *Moss* 3344; Richmond, *Wood* 84, 9852; Estcourt, *Wood* 10261, *Wylie* (*Wood* 10006); Field's Hill, *Wood* 12830; *Evans* 146; Illovo, *Wood* 6411.

ZULULAND.—Inyiza, *Edwards* 315; Ngoya, *Wood* 9314; Nkandhla, *Wylie* (*Wood* 8817).

21. **P. affinis** E. and Z.

A tall virgate shrub up to 18 metres. *Stems* woody, striate, glandular, slightly pilose when young. *Leaves* imparipinnate with 2–4 pairs of leaflets, stipulate, petiolate; petioles 0·7–2·3 cm. long; leaflets up to 5 cm. long, 6 mm. broad, linear-lanceolate to ovate-lanceolate, obtuse, glandular, mucronulate. *Stipules* small, deltoid. *Flowers* axillary, 1–3 or

more together. *Pedicels* up to 4·5 cm. long, bracteolate near the apex. *Bracts* bi-lobed, up to 5 mm. long, pilose, glandular, veined. *Calyx-tube* 4 mm. long, 1 cm. in diameter, thickly nigro-punctate, sparsely to densely nigro-hirsute, veined; lobes lanceolate-ovate to ovate, acute, hirsute, nigro-punctate, hirsute on the inner surface; upper and lateral lobes 3·5–4 mm. long, 2 mm. broad; lowest lobe 5 mm. long, 3–4 mm. broad. *Vexillum* 0·9–1·2 cm. long, 1·2–1·7 cm. broad, obovate, geniculate, with a linear claw 3–4 mm. long; alae 0·8–1·1 cm. long, 5 mm. broad, with a linear claw 5–6 mm. long; carina 6–7·5 mm. long, 4–4·5 mm. broad, with a linear claw 6–8 mm. long. *Style* 0·8–1 cm. long.

Flowers: Deep blue or purple.

CAPE.—Riversdale district: Riversdale, near Albertinia, *Muir* 1851; George district: George, *Rogers* 4291; Port Elizabeth district: Port Elizabeth, Van Staadensberg, *Zeyher* 2378; Albany district: Grahamstown, *Rogers* 27423; Stutterheim district: Stutterheim, *Ecklon* and *Zeyher*, Rooi Vaal, *Flanagan* 178.

TRANSVAAL.—Barberton district: Barberton, *Pole Evans*, *Rogers* 14015; Middelburg district: Waterval Boven, *Rogers* 2743; Lydenburg district: Lydenburg, *Rogers* 14564, 23110.

SWAZILAND.—Mbabane, *Rogers* 11457.

BASUTOLAND.—MacaMac, Drakensberg, *MacLea* 3017.

LOCALITIES UNKNOWN.—*Burchell* 6038, *Rogers* 17382.

22. **P. repens** L.

Plant suffruticose. *Stems* procumbent or prostrate, sparsely pilose, glandular. *Leaves* trifoliolate, petiolate, stipulate; petioles up to 3 cm. long, glandular, sparsely pilose; young petioles more thickly pilose; leaflets thick, 0·5–1·5 cm. long, 2-6 mm. broad, obovate to obovate-oblong, cuneate, retuse or obtuse, nigro-punctate, sparsely pilose. *Stipules* up to 2 mm. long, ovate, acute. *Flowers* axillary, 1 or more together. *Pedicels* equalling the leaves, glandular, pilose, bracteolate near the middle. *Bracts* about 2·5 mm. long, bi-lobed, ovate, acuminate, pilose, glandular. *Calyx-tube* 2–4 mm. long, 5-7 mm. in diameter, glabrous or laxly hairy, thickly nigro-punctate; lobes ovate, obtuse, glabrous or villous, ciliate, nigro-punctate, shortly pilose on the inner surface; upper and lateral lobes 1·5–3 mm. long 1–2·5 mm. broad, lowest lobe 1·3–4 mm. long, 1–2·5 mm. broad. *Vexillum* 6–8 mm. long, 6·5–9 mm. broad, obovate, glandular, with a narrow claw 1·2 mm. long; carina 5–6 mm. long, 2–3 mm. broad, with a linear claw 3–4 mm. long; alae 6–7·5 mm. long, 1·5–3 mm. broad, with a linear claw 2–3 mm. long. *Ovary* glabrous, sometimes glandular; style 5-7 mm. long, filiform.

Flowers: October–April.

CAPE.—Cape district: Near Retreat, *Bolus* 3076, Kalk Bay, *Bolus* 3076, *Moss* 3340, *Wolley Dod* 2216, Wynberg, and Tigerberg, *Zeyher* 1525, Kuils River, *Zeyher* 2384; Humansdorp district: Humansdorp, Slang River, *Phillips*; Port Elizabeth district: Port Elizabeth, *Kemsley* 221, *Potts* 303, *Christie* 56, Redhouse, *Paterson* 587; Uitenhage district: Zwartkops River, *Zeyher* 2377, Algoa Bay, *Zeyher* 1526, *Zeyher* 668, New Brighton, *Southey*.

23. **P. bracteata** Linn.

A low suffruticose. *Stems* diffuse or erect, virgate, leafly, pubescent when young, becoming glabrous. *Leaves* trifoliolate, shortly petiolate, stipulate; petioles up to 3 mm long; leaflets up to 2·6 cm. long and 1·5 cm. broad, broadly obovate or cordate, glabrescent, pellucid-dotted, recurved mucronate. *Stipules* adnate to the base of the petiole, up to 8 mm. long, lanceolate, ovate, acute, striate. *Inflorescence* terminal, spicate, having the appearance of a capitulum, sessile. *Flowers* subtended by bracts variable in size and shape. *Calyx-tube* 2·5–5 mm. long, 4·5–8 mm. in diameter, laxly hirsute or villous, pellucid-dotted,

distinctly 10-nerved ; lobes pellucid-dotted, long ciliate, laxly hirsute or villous, glabrous or sparsely pilose on the inner surface ; upper and lateral lobes 1·5–8 mm. long, 0·5–1·5 mm. broad, lanceolate, acute, slightly sub-falcate ; lowest lobe 0·4–1 cm. long, 1·5–5 mm. broad, broadly ovate, cuspidate, reticulately veined. *Vexillum* 0·4–1·1 cm. long, 4–7 mm. broad, obovate-oblong or sub-orbicular, slightly geniculate with a channelled claw 1·5–3·5 mm. long ; alae 0·4–1 cm, long, 1–3 mm. broad, with a linear claw 2·5–4 mm. long ; carina 2·5–4·5 mm. long, 1–2 mm. broad, with a linear claw 3–5 mm. long. *Ovary* glabrous or slightly pilose ; style 3–5 mm. long, glabrous. *Pod* turgid 5·5 mm. 3 mm. broad, glabrous ; seed small, purplish-brown.

Flowered : June–January. Flowers : White to blue.

CAPE.—Paarl district : Wellington, *Tyson* 917, Du Toit's Kloof, *Bolus* 5158 ; Cape district : Capetown, *Paterson* 50, *Rogers* 27003, Green Point, *Zeyher*, Table Mountain, *Rogers* 17809, *Bolus* 1085, Newlands, *Forbes* 90, Rondebosch and Wynberg, *Ecklon* and *Zeyher* 1543, Wynberg, *Wolley Dod* 19, Muizenberg, *Pillans* 3427, Fish Hoek, *Wolley Dod* 712, *Rogers* 16087, Cape Point, *Forbes* 182, Hout Bay, *Galpin* 3967, Lakeside, *Moss* and *Rogers* 1633 ; Caledon district : Houw Hoek, *Schlechter* 9435 ; George district : George, *Schlechter* 2349, 5863, Georgetown, *Hops* ; Knysna district : Knysna, *Keet* 247, between Knysna and Grahamstown, *Bolus* 1085 ; Humansdorp district : Humansdorp, Witte Els Bosch, *Fourcade* 937, near Zitzikamma, *Forest Dept.* 71 ; Uitenhage district : Uitenhage, *Zeyher* 393, Zwartkops River, *Ecklon* and *Zeyher* 1544, 1549, *Zeyher* 2372 ; Port Elizabeth district : Port Elizabeth, *Kemsley* 131, *West* 245, Staadens Mountains, *Zeyher*, Van Staadens River, *Zeyher* 2376 ; Albany district : Grahamstown, *MacOwan* 314 ; Kingwilliamstown district : Kingwilliamstown, *Tyson*, Rattel River, *Schlechter* 9723 ; De Aar district : Philipstown, *Ecklon* and *Zeyher* 1548.

24. **P. Bowieana** Harv.

Plant suffruticose. *Stems* slender, 6 or more metres long, diffuse, branching, puberulous, *Leaves* trifoliolate, shortly petiolate, stipulate ; petioles 2 mm. long, leaflets 2–2·5 cm. long, 6–7·5 mm. broad, cuneate-obovate, recurved-mucronate, pellucid-dotted, ciliate, laxly hispid when young, becoming glabrous. *Peduncles* axillary, longer than the leaves, racemose. *Pedicels* 2–3 together, equalling the calyx. *Bracts* lanceolate. *Calyx-tube* pale, sub-glabrous ; lobes narrow-lanceolate ; lowest lobe longest ; calyx segments each marked with three purple striae.

CAPE.—Cape, *Bowie*.

Description taken from " Flora Capensis." No specimen seen.

25. **P. decumbens** Ait.

Plants suffruticose or decumbent. *Stems* slender, striate, decumbent, young parts densely clothed with cano- or rufo-pubescence, becoming glabrous. *Leaves* trifoliolate, stipulate, petiolate ; petioles up to 5 mm. long ; leaflets 0·8–1·6 cm. long, 4–6 mm. broad, cuneate or cordate, recurved-mucronate, nigro-punctate, pubescent. *Stipules* up to 6 mm. long, adnate to the base of the petiole, hyaline, ovate, very acute. *Flowers* axillary, 1–3 together, often crowded at the ends of the branches. *Pedicels* up to 2 mm. long. *Calyx-tube* 2–3 mm. long, 3·5–5 mm. in diameter, villous or sparsely hirsute ; lobes lanceolate, acute, long ciliate, villous or sparsely hirsute, shortly pilose on the inner surface ; upper and lateral lobes 1–4 mm. long, 0·5–1 mm. broad ; lowest lobe 3–6·5 mm. long, 1–2 mm. broad ; glands present on tube and lobes, especially on the lowest lobe. *Vexillum* 4·5–7 mm. long, 4–6 mm. broad, obovate, with a channelled claw 1·5–3 mm. long ; alae 4·5–7 mm. long, 1·5–2·5 mm. broad, with a linear claw 2–3 mm. long ; carina 2·5–4 mm. long, 1–1·5 mm. broad, with a linear claw 2·5–3 mm. long. *Ovary* glabrous ; style 3–4 mm. long, glabrous.

Cape.—Piquetberg district: Piquetberg, *Bolus*; Malmesbury district: Moorreesburg, *Bolus* 9957; Tulbagh district: Tulbagh, *Rogers* 17436, *Zeyher*; Ceres district: Mitchell's Pass, *Schlechter* 9971; Cape district: Table Mountain, *Bolus* 2770, 2771, 4272, *Ecklon* and *Zeyher* 1538, *MacOwan* 73, *Moss* 2610, Rosebank, *Pillans* 3474, Rondebosch, *Hutton*, *Forbes* 179, Rondebosch and Newlands, *Wolley Dod* 1901, Kirstenbosch, *Verdoorn*, *Forbes* 87; Stellenbosch district: Somerset Strand, *Rogers* 17674; Paarl district: French Hoek, *Phillips* 1090; Caledon district: Sir Lowry's Pass, *Galpin* 369, Houw Hoek, *Schlechter* 5440; Riversdale district: Riversdale, *Muir* 5085; Swellendam district: Swellendam, *Kennedy*; Robertson district: Barrydale, *Galpin* 3963; Humansdorp district: Humansdorp, *Bolus* 2294; Uitenhage district: Zwartkop River, *Ecklon* and *Zeyher* 1033, *Zeyher* 445; Port Elizabeth district: Redhouse, *Paterson* 206, Humewood, *Paterson* 2613, *West* 246; Albany district: Grahamstown, *MacOwan* 818, 1083, *Rogers* 1567, Signal Hill, *Dale* and *Cherry* 1025, *Balcock*, Kaffraria, Mount Coke, *Sim* 1507, Bethelsdorp, *Zeyher*.

26. **P. argentea** Thunb.

Plant a slender shrub. *Stems* diffuse or sub-erect, leafy, clothed with adpressed whitish pubescence. *Leaves* trifoliolate, petiolate, stipulate; petioles 2–4 mm. long; leaflets 6–8 mm. long, 4–5 mm. broad, obovate, recurved-mucronate, minutely pellucid-dotted, thinly canescent on both surfaces. *Flowers* in threes, axillary or in an interrupted terminal pedunculate raceme. *Bracts* minute. *Calyx-tube* silky canescent; lobes lanceolate, two uppermost semi-connate.

Description from "Flora Capensis." No specimen seen.

27. **P. biflora** Harv.

Plant low-growing, forming a thick carpet, much branched, pubescent when young, becoming glabrous. *Leaves* trifoliolate, petiolate, stipulate; petioles up to 4 mm. long; leaflets thickish 2–3 mm. long, 2–2·5 mm. broad, obovate, nigro-punctate, pubescent when young, glabrous or with a few scattered hairs when older, with distinct veining on the lower surface. *Stipules* minute, ovate, withering. *Flowers* axillary; two sessile flowers on peduncle. *Peduncle* bracteolate at apex. *Bracts* very small. *Calyx-tube* 3 mm. long, 4·5 mm. in diameter, hispid, glandular, distinctly 10-nerved; lobes oblong, obtuse, hispid, ciliate, glandular, pilose on the inner surface; upper and lateral lobes 1·5–2 mm. long, 0·5 mm. broad; lowest lobe broadest, 2 mm. long, 1 mm. broad. *Vexillum* 3·5 mm. long, 4 mm. broad, obovate, geniculate, claw 1 mm. long, with a slight appendage at the apex; alae 3·5 mm. long, 2 mm. broad, with a linear claw 2·5 mm. long; carina 2 mm. long, 1·5 mm. broad, with a linear claw 2·5 mm. long. *Ovary* pilose; style 1·5 mm. long, glabrous or very sparsely pilose.

Flowers: Blue with a white vexillum.

South West Africa.—Keetmanshoop to Windhoek, *Pearson*, in *Percy Sladen Memorial Expedition.*

28. **P. obtusifolia** D.C.

A small diffuse plant. *Stems* up to 9 metres, slender, spreading, villoso-canescent, becoming glabrous when older: very pale. *Leaves* trifoliolate, petiolate stipulate; petioles usually fairly long, 0·5–7 cm. long; leaflets 0·3–2·1 cm. long, 0·2–1·5 cm. broad, obovate or elliptic obtuse, thinly canescent, glandular, plicate, with margins slightly dentate. *Stipules* up to 3 mm. long, ovate, acute, ciliate, canescent. *Inflorescence* axillary, spicate. *Peduncles* with 3–8 flowers. *Flowers* sub-sessile. *Calyx-tube* 1·5–4 mm. long, 3–5 mm. in diameter, densely albo-villous; lobes lanceolate-ovate, ciliate, villous, pilose on the inner surface; upper and lateral lobes 1–2 mm. long, 0·5–1 mm. broad; lowest lobe 2–4·5 mm. long, 1–1·5 mm. broad. *Vexillum* 3–5 mm. long, 3–4 mm. broad, obovate, with a channelled claw 1–1·5 mm. long; alae 3–4·5 mm. long, 1–2 mm. broad, with a linear claw 1·5–4 mm. long; carina 2–3 mm. long, 1–1·5 mm. broad, with a linear claw 2–2·5 mm. broad. *Ovary* villous; style 1–3 mm. long, glabrous or sparsely pilose.

CAPE.—Cape district: Newlands, *Wilman*; Swellendam district: Gauritz River, *Zeyher* 450; Calvinia district: Near Twee River, *Burtt-Davy* 17562; Graaff-Reinet district: Graaff-Reinet, *Bolus* 127; Beaufort West district: Murraysburg, *Bolus* 35: Kimberley district: Barkly West, *W.G.B.* 637, *Bolus* 6814, near Vaal River, *Bolus* 68(3; Vryburg district: Vryburg, *Sharpe*; Kuruman district: Kuruman, *Burtt-Davy*, Langberg, *Lanham* 4032.

SOUTH WEST AFRICA.—Great Namaqualand, Ramansdrift, *Schlechter* 11459; Holoog, *Pearson* 9808; Kiubis, *Pearson* 8012, 8026; Tsubgaus, *Pearson* 9204: Great Fish River, *Pearson* 9210, 9805, 9274; Tsondat, *Pearson* 9189; Kalahari, *Ireland* 16134: Krai Kluft Ravine, *Pearson* 8280; Walvis Bay, *Marloth* 1481.

NAMAQUALAND MINOR.—Near Henkies, *Phillips* 1587.

TRANSVAAL.—Pretoria district: Pienaar's River, *Schlechter* 4211; Bloemhof district: Christiana, *Burtt-Davy*; Zeerust district: Zeerust, *Potts* 4257, *Burtt-Davy*.

ORANGE FREE STATE.—Boshof District: *Burtt-Davy*; Bloemfontein district: Bloemfontein, *Burtt-Davy*; Heilbron district, Heilbron, *Flanagan* 1459.

LOCALITY UNKNOWN.—*Dinter* 125.

29. **P. rotundifolia** Linn.

A suffruticose about 3 metres high. *Stems* ascending, leafy, densely hispid, becoming glabrous when older. *Leaves* unifoliolate, petiolate, stipulate, 0·9–2·7 cm. broad, 0·9–4 cm. long, ovate to ovate-elliptic, obtuse or acute, mucronulate, sparsely glandular, with reticulate veining, glabrous; petioles up to 5 mm. long. *Stipules* adnate to the base of the petiole, equalling or exceeding the petiole, lanceolate, subulate veined, glabrous, glandular. *Inflorescence* spicate, many-flowered. *Peduncles* terminal and axillary, 4–6 mm. long, hairy. *Flowers* on short pedicels, subtended by a small bract. *Calyx-tube* 3 mm. long, 7 mm. in diameter, densely hirsute with long white hairs, glands translucent; lobes lanceolate-ovate, long hirsute, ciliate, thinly pilose on the inner surface; upper and lateral lobes 6–7 mm. long, up to 2 mm. broad; lowest lobe 1·1 cm. long, 3 mm. broad. *Vexillum* about 1 cm. long and 5 mm. broad, obovate, with a channelled claw 2 mm. long; alae 8 mm. long, 2·5 mm. broad, with a linear claw 3·5 mm. long; carina 5·5 mm. long, 2·5 mm. broad, with a linear claw 4 mm. long. *Ovary* hispid; style 4 mm. long. *Pod* membraneous, about 6 mm. long and 5 mm. broad, hispid.

Flowers: July–April.

CAPE.—Caledon district: Houw Hoek, *Bolus* 80, near Klein River; Clanwilliam district: Vogelgat, *Schlechter* 9503, 10417.

30. **P. Thomii** Harv.

A small suffruticose. *Stems* slender, ascending, hairy. *Leaves* unifoliolate, petiolate, stipulate, 1–4 cm. long, 0·5–2·15 cm. broad, elliptic-lanceolate to elliptic-ovate or oblong, mucronulate, with reticulate veining, no glands present, densely hairy when young and never becoming quite glabrous; petioles up to 5 mm. long. *Stipules* about 7 mm. long and 2 mm. broad, ovate, acute, nerved, hispid. *Inflorescence* spicate. *Peduncles* terminal and axillary, bracteate, hairy, exceeding the leaves. *Flowers* sessile or sub-sessile. *Calyx-tube* 3–3·5 mm. long, 7 mm. in diameter, veined, thickly hirsute; lobes linear-lanceolate to ovate-lanceolate, acute, hirsute, glabrous on the inner surface; upper and lateral lobes 5–9 mm. long, 1·5–2 mm. broad; lowest lobe 0·8–1 cm. long, 2·5–3 mm. broad. *Vexillum* 1·15–1·4 cm. long, 8–9 mm. broad, obovate with a linear claw 1·5 mm. long; alae 0·9–1 cm. long, 3 mm. broad, with a linear claw 4 mm. long; carina 5–6 mm. long, 2·5–3 mm. broad, with a linear claw 4·5–5 mm. long. *Ovary* pilose; style 4–5 mm. long, pilose.

Flowers: July–October.

CAPE.—Caledon district: Hermanus, *Bolus* 6378, Pieter's Fontein, *Bodkin* (*Bolus* 6378).

31. **P. aculeata** L.

An erect virgate shrub up to 12 metres. *Stems* woody, branched, leafy, glabrous, glandular, spiny with persistent stipules. *Leaves* trifoliolate, petiolate, stipulate; petioles 1·5–4 mm. long, glandular, glabrous; leaflets thickish, 1·5–8 mm. long, up to 2 mm. broad, cuneate, nigro-punctate on both surfaces, with a sharply curved mucro. *Stipules* adnate to the base of the petiole, 2–3 mm. long, persistent, subulate. *Flowers* axillary, solitary or 1–3 together. *Pedicels* up to 1·3 cm. long, bracteolate near the apex, often crowded on the upper parts of the stem. *Bracts* about 5 mm. long, connate, ovate, acuminate, nigro-punctate. *Calyx-tube* 3–5·5 mm. long, 0·8–1·1 cm. in diameter, glabrous, thickly glandular, nerved; lobes ovate, acuminate, glabrous, glandular, pilose on the inner surface, upper and lateral lobes 2·5–6 mm. long, 1·5–3·5 mm. broad; lowest lobe 0·3–1 cm. long, 2–5·5 mm. broad. *Vexillum* 0·8–1·3 cm. long, 0·8–1·5 cm. broad, obovate, geniculate, with a channelled claw 1–3 mm. long; alae 0·7–1 cm. long, 3·5–6 mm. broad, with a linear claw 2·5–5 mm. long; carina 4–8 mm. long, 3–5 mm. broad, with a linear claw 3·5 mm. long. *Ovary* 1–2 mm. long, glabrous; style 4·5–8 mm. long, glabrous.

Flowers: August–November.

CAPE.—Cape district: Table Mountain, *Ecklon* and *Zeyher* 1545, *MacOwan*, *Galpin* 3966, *Bolus* 4660, *Rogers* 17744, Orange Kloof, *Wolley Dod* 20; Stellenbosch, Hottentots Holland Mountains, near Gordon's Bay, *Bolus* 9865, 9933; Clanwilliam district: near Vogelgat, *Schlechter* 9516.

32. **P. Keetii** Schonl.

A shrub. *Stems* erect, glabrous, glandular. *Leaves* trifoliolate, petiolate, stipulate; petioles up to 1 cm. long; leaflets 0·5–2·5 mm. long, 0·4–1·1 cm. broad, obovate, thickly nigro-punctate, glabrous, mucronulate; terminal leaflet on short petiole: lateral leaflets sub-sessile. *Stipules* not exceeding 5 mm. long, ovate, lanceolate, acute. *Flowers* axillary, solitary. *Pedicels* up 3·5 cm. long, bracteolate at the apex. *Bracts* tri-lobed, 2–3 mm. long, ovate, acuminate, glandular, glabrous. *Calyx-tube* 3 mm. long, 8 mm. in diameter, glabrous, thickly glandular; lobes ovate, acute, glandular, glabrous, ciliate, pilose on the inner surface; upper and lateral lobes 2–4 mm. long, 1–5 mm. broad; lowest lobe slightly longer. *Vexillum* 8 mm. long, 1 cm. broad, obovate; claw channelled, 3 mm. long, with two slight appendages at the apex; alae 8 mm. long, 4 mm. broad, with a linear claw 4 mm. long; carina 6 mm. long, 4 mm. broad, with a linear claw 6 mm. long. *Ovary* glabrous; style 7 mm. long, glabrous.

Flowered: January. Flowers: Colour, light blue.

CAPE.—Knysna district: Hoogeberg, *Keet* 1055 (Type).

33. **P. polysticta** Benth.

A shrub, up to 10·5 metres. *Stems* woody, erect, striate, hairy, becoming almost glabrous when older, glandular. *Leaves* trifoliolate, sub-sessile or very shortly petioled, stipulate; petioles about 3 mm. long; leaflets 0·9–3·6 cm. long, 0·3–1·5 cm. broad, oblong, cuneate, nigro-punctate, recurved-mucronate, glabrescent. *Stipules* small, deltoid. *Flowers* axillary in clusters. *Peduncles* 2–4 mm. long with 3 or more short pedicels to each peduncle. *Calyx-tube* 2–3·5 mm. long, 5–7 mm. in diameter, veined, tomentulose, glandular; lobes lanceolate, acute, tomentulose, glandular, pilose on the inner surface; upper and lateral lobes 1–3·5 mm. long, about 1 mm. broad; lowest lobe 4–5 mm. long, 1–1·5 mm. broad. *Vexillum* 6–8 mm. long, 5–6 mm. broad, obovate, with a short claw 0·5–2 mm. long; alae 5–7 mm. long, 1·5–2 mm. broad, with a linear claw 2·5–3 mm. long; carina 3–4 mm. long, 1·5–2 mm. broad, with a linear claw 3–4 mm. long. *Ovary* glabrous; style 3·5 mm. long.

Flowers: August–April.

The following note is attached to Mrs. Dieterlen's specimen No. 372 in the S.A. Museum :—

" Sesuto—Mohlonecha.—He who makes respectable. A chief who wishes to have prestige in the sight of his subjects must bathe the whole of his body with a decoction of this plant. The burnt root is smoked as a cure for cold in the head."

CAPE.—Uitenhage district: Uitenhage, *Drege*: Oudtshoorn district: Oudtshoorn, *Taylor* 323; Albany district: Zuurberg, *Paterson* 11, Griqualand East, Mount Currie, *Tyson* 1319, Dornkop, *Zeyher*, *Tyson* 519.

TRANSVAAL.—Pietersburg district: Pietersburg, *Moss* and *Rogers* 1330: Messina district: Louis Trichardt, *Rogers* 21148; Heidelberg district: Heidelberg, *Burtt-Davy* 15435.

SWAZILAND.—Hlatikulu, *Stewart* 181.

ORANGE FREE STATE. -*Cooper* 1114.

BASUTOLAND.—Leribe, *Dieterlen* 372.

NATAL.—Ladysmith, *Wood* 8010; Estcourt, *Wood* 9953; Weenen County: Blaaukrans, *Wood* 3517; Boston, *Wood* 9900.

NO LOCALITY.– *Gerrard* and *McKen* 110.

34. **P. carnea** E. Mey.

A shrub 12–15 metres high. *Stems* leafy, reddish pubescent, at length becoming glabrous. *Leaves* trifoliolate, stipulate, sub-sessile; leaflets up to 1·5 cm. long and 7 mm. broad, oblong to cuneate-oblong, obtuse, pellucid-dotted, recurved mucronate, glabrous. *Stipules* about 2 mm. long, deltoid. *Flowers* axillary, 2–3 together. *Pedicels* very short. *Calyx-tube* 2–3·5 mm., 5–6 mm. in diameter, veined, hirsute, glandular; lobes linear-lanceolate, lanceolate or ovate, acute, glandular, ciliate, hirsute, glabrous on the inner surface; upper and lateral lobes 2–3·5 mm. long, 0·5 1 mm. broad; lowest lobe 3–5 mm. long, 1–1·5 mm. broad. *Vexillum* 6 7 mm. long, 5 6 mm. broad, obovate, with a channelled claw 1–2 mm. long; alae 5·5-7 mm. long, 2–2·5 mm. broad, with a liner claw 2·5–3 mm. long; carina 3 4 mm. long, 1·5-2 mm. broad, with a linear claw 3–4 mm. long. *Ovary* glabrous or very slightly pilose; style 2–4 mm. long, glabrous.

Flowers: August–March.

CAPE.—Riversdale district: Riversdale, *Muir* 484, Langebergen, *Schlechter* 5691; Oudtshoorn district: Oudtshoorn, *Britten* 80; Knysna district: Knysna, *Keet* 278, 2716, *Fourcade* 1519, Plettenberg Bay, *Rogers* 15513, Clarkson, *Galpin* 3961, *Schlechter* 6012; Humansdorp district: Humansdorp, *Fourcade* 2330, Assegai Bosch, *Fourcade* 857, *Schonland* 3618, *Rogers* 2833; Albany district: Howison's Poort, *MacOwan*.

35. **P. obliqua** E. Mey.

An erect shrub up to 15 metres. *Stems* branched, villous when young, at length glabrescent, leafy. *Leaves* trifoliolate, petiolate, stipulate; petioles up to 6 mm. long; leaflets up to 3·1 cm. long and 1 cm. broad, elliptic-oblong, obtuse, mucronulate, densely glandular, glabrescent, shiny; lateral leaflets unequal sided. *Stipules* membraneous, about 6 mm. long and 2·5 mm. broad, ovate. *Flowers* axillary, in threes. *Pedicels* shorter than the leaves; sometimes three pedicels on short peduncle. *Calyx-tube* 2 mm. long, 7–8 mm. in diameter, nerved, glandular, villous; lobes villous, glandular, ciliate, glabrous on the inner surface; upper and lateral lobes 4–5 mm. long, 1–1·5 mm. broad, lanceolate, acute; lowest lobe up to 8 mm. long, and 3 mm. broad, ovate, very acute, almost cuspidate. *Vexillum* 9 mm. long, 7–8 mm. broad, obovate, with a channelled claw 1 mm. long; alae up to 1 cm. long, 3–4 mm. broad, with a linear claw 2–3 mm. long; carina 3–4 mm long, 2 mm. broad, with a linear claw 2–3 mm. long. *Ovary* glabrous; style 2·5 mm. long, glabrous.

Flowers: July–November.

CAPE.—Stellenbosch district: Stellenbosch, *Duthie*; Caledon district: near Palmiet River, *Zeyher* 1525, Hottentots Holland Mountains, *Zeyher*; Paarl district: French Hoek, *Phillips* 1088.

36. **P. macradenia** Harv.

A shrub. *Stems* branched, erect, leafy, striate, glandular, silky canescent when young, becoming glabrous when older. *Leaves* trifoliolate, stipulate, sub-sessile; leaflets 1·9 cm. long, 8·5 mm. broad, obovate, cuneate, recurved mucronate, canescent when young, becoming glabrous, nigro-punctate on the upper surface with large and prominent glands on the lower surface. *Stipules* up to 2·5 mm. long, subulate, acute, canescent. *Flowers* axillary, 1–3 together. *Pedicels* short; sometimes three sub-sessile flowers on a short peduncle. *Calyx-tube* 3 mm. long, 7 mm. in diameter, veined, canescent, very sparsely glandular; lobes lanceolate-ovate, acute, sparsely glandular and canescent; upper and lateral lobes 3 4 mm. long, 1–1·5 mm. broad; lowest lobe 5·5 mm. long, 1·5 mm. broad. *Vexillum* 5 mm. broad, 6·5 mm. long, obovate, with a channelled claw 1·5 mm. long: alae 6·5 cm. long, 2 mm. broad, with a linear claw 3 mm. long; carina 4 mm. long, 2 mm. broad, with a linear claw 3 mm. long. *Ovary* glabrous: style 3·5 mm. long, glabrous.

Flowers: July August.

CAPE.—Riversdale district: Langebergen, *Muir* 1113.

37. **P. tomentosa** Thunb.

A shrub up to 24 metres. *Stems* erect, leafy, densely cano-pubescent, at length becoming glabrous. *Leaves* trifoliolate, petiolate, stipulate; petioles up to 2·5 cm. long: leaflets 0·6–4·5 cm. long, 0·5 1·8 cm. broad, elliptic or elliptic-lanceolate, mucronulate, with the upper surface glabrous or sparsely pilose and the lower surface densely canescent. *Stipules* up to 1·3 cm. long and 3 mm. broad, lanceolate, acute or subulate, cano-pubescent or glabrescent. *Inflorescence* axillary, or terminal. *Peduncles* up to 14 cm. long. *Flowers* in dense globose heads, sub-sessile; each flower subtended by a bract. *Bracts* up to 1 cm. long, ovate or lanceolate, villous, striate with dark lines. *Calyx-tube* 3-7 mm. long, 0·7–1·3 cm. in diameter, with reticulate veining, villoso-hirsute; lobes lanceolate, acute, reticulately veined, villous, pilose on the inner surface, ciliate: upper and lateral lobes 3–7 mm. long, 1–2·5 mm. broad: lowest lobe 0·75 1 cm. long, 2–3 mm. broad. *Vexillum* 7-8 mm. long, 2 8 mm. broad, obovate, geniculate, distinctly veined, with a channelled claw 2-5 mm. long; alae 4·5 8 mm. long, 2·3 5 mm. broad, with a linear claw 3·5–6 mm. long; carina 3 5 mm. long, 2 5 mm. broad, with a linear claw 5 6·5 mm. long. *Ovary* glabrous; style 5–7 mm. long. Glands present but very minute. The whole plant has a silvery appearance owing to the silky cano-pubescence.

Flowers. August January.

CAPE.—George district: Outeniqua Mountains, *Hops* (*Bolus* 11795), *Schlechter* 5771 *Pappe*; Riversdale district: Riversdale, *Muir*; Knysna district: Knysna, *Duthie* 517, *Keet* 1025, *Williamson* 134, *Tyson* 973 *Keet* 856, *Zeyher*, Plettenberg Bay, *Rogers* 15450, 27061; Humansdorp district: Humansdorp, *Galpin* 3958, *West* 247, *Rogers* 2910, Witte Els Bosch, *Fourcade* 899, Ratels Bosch, *Fourcade* 69; Uitenhage district: Uitenhage, *Zeyher*; Albany district: Grahamstown, *MacOwan* 26, Featherstone's Kloof, *Bolus* 1939, Trapp's Valley, *Daly* 601, Howison's Poort, *Britten* 2980, *Glass* 17, Highlands, *Paterson*; Prince Albert district: Zwartberg Pass, *Bolus* 11476.

LOCALITIES UNCERTAIN: Kleinmonde, *White* 946A, Inalgaten River, *Young* 5516.

38. **P. zeyheri** Harv.

A suffruticose, about 3 metres high. *Stems* slender, ascending, pubescent. *Leaves* trifoliolate, petiolate, stipulate; petioles up to 1·5 cm. long, striate, pubescent; leaflets 0·7–4·2 cm. long, 0·4–1·5 cm. broad, broadly obovate, mucronulate, villous, becoming glabrescent; a few of the upper leaflets linear to ovate-linear. *Stipules* adnate to the base of the petiole, up to 1·3 cm. long, subulate or lanceolate, acute, hispid, ciliate. *Inflorescence* terminal, and axillary, spicate. *Peduncles* 5·5–16 cm. long, hirsute. *Flowers* sub-sessile, each subtended by a bract. *Bracts* ovate or linear, acute. *Calyx-tube* 3–4 mm. long, 5–6 mm. in diameter, with dark and reticulate veins, densely albo-hirsute, lobes albo-hirsute, glabrous on the inner surface; upper and lateral lobes 3–8 mm. long, 0·5–1 mm. broad, linear-lanceolate; lowest lobe 5–9 mm. long, 1·5–2·5 mm. broad,

reticulately veined, ovate-lanceolate. *Vexillum* 0·6–1·2 cm. long, 5–7 mm. broad, obovate, with a channelled claw 0·5–3 mm. long; alae 6–9 mm. long, 1·5–3 mm. broad, with a linear claw 1–4·5 mm. long: carina 3–5 mm. long, 1–2 mm. broad, with a linear claw 4–5 mm. long. *Ovary* glabrous; style 6 mm. long, glabrous.

Flowers: November–January.

CAPE.—Stellenbosch district: Palmiet River Mountains, *Stokoe* 17507; Caledon district: Caledon, *Zeyher* 2375, Houw Hoek, *Bolus* 6935, near Sir Lowry's Pass, *Schlechter* 9505, near Rooi Els, *Stokoe* 17342.

39. **P. Patersoniae** Schonl.

A shrub. *Stems* erect, striate, glandular-scabrid, tomentose, at length glabrescent. *Leaves* trifoliolate, stipulate, petiolate; petioles 3–5·5 cm. long; leaflets 1·5–5·5 cm. long, up to 4 cm. broad, obovate, acute, cuneate at the base, dentate-creniculate, mucronulate, nigro-punctate, glabrescent; lateral leaflets sub-sessile; terminal leaflets on petioles 0·7–2 cm. long. *Stipules* up to 1 cm. long, lanceolate, ovate, acute, tomentulose, glandular. *Inflorescence* axillary, spicate. *Peduncles* up to 6 mm. long. *Flowers* 2–3, subtended by a bract, shortly pedicelled. *Bracts* up to 1 cm. long, ovate, lanceolate, acute, tomentulose, glandular. *Calyx-tube* 2 mm. long, 5 mm. in diameter, tomentose, glandular; lobes lanceolate, ciliate, tomentose, glandular, glabrous on the inner surface; upper and lateral lobes 2–3 mm. long, 0·7 mm. broad, lowest lobe 5 mm. long, 1·5 mm. broad. *Vexillum* 5 mm long, 4 mm. broad, obovate, with a channelled claw 1·5 mm. long: alae 5 mm. long, 1·5 mm. broad, with a linear claw 3 mm. long; carina 3 mm. long, 2 mm. broad, with a linear claw 3 mm. long. *Ovary* glabrous; style 3·5 mm. long, glabrous.

Flowers: December.

CAPE.—Port Elizabeth district: Redhouse, *Paterson* 393 (Type).

40. **P. caffra** E. and Z.

An erect shrub up to 6 metres. *Stems* leafy, striate, with prominent glands, tomentulose, at length glabrescent. *Leaves* trifoliolate, petiolate, stipulate: petioles up to 1·8 cm. long; leaflets 1–4·5 cm. long, 0·7–3 cm. broad, broadly elliptic or obovate, rounded at the apex, mucronulate, thickly nigro-punctate, tomentulose, at length glabrescent: terminal leaflet on a petiole up to 1·1 cm. long. *Stipules* 2–5 mm. long, deltoid, acuminate, pilose. *Inflorescence* terminal or axillary, laxly or densely spicate. *Peduncles* up to 5 cm. long. *Flowers* in whorls of three subtended by a bract. *Bracts* up to 3 mm. long, ovate, acuminate pilose. *Pedicels* about 1 mm. long. *Calyx-tube* 2–3 mm. long, 4·5–6 mm. in diameter, nerved, tomentose, nigro-punctate: lobes lanceolate, acute, tomentose, nigro-punctate, pilose on the inner surface; upper and lateral lobes 1–2·5 mm. long, 0·5–1 cm. broad; lowest lobe 2–4 mm. long, 1–1·5 mm. broad, acuminate. *Vexillum* 5–7 mm. long, 5–7 mm. broad, obovate, with a channelled claw 0·7–2·5 mm. long; alae 5–6·5 mm. long, 1·5–2·5 mm. broad, with a linear claw 2·5–4 mm. long: carina 3–3·5 mm. long, 1·5–2 mm. broad, with a linear claw 3–4·5 mm. long. *Ovary* pilose; style 3–4 mm. long, pilose. *Pod* membraneous, 5·5–7 mm. long, 3–4 mm. broad, hirsute, enclosed in calyx; seed small, hard and brown.

Whole plant has large conspicuous wart-like glands.

CAPE.—Cape district: Fort Beaufort district: Hogsback, *Rattray* 32A; Queenstown district: Katberg, *Bolus* (*Herb.* 1993), *Galpin* 2068, between Kat and Kei Rivers, *Zeyher* 1550; Cathcart district: Cathcart, *Galpin* 7361; Stutterheim district; Stutterheim, Mountains above Dohne, *Flanagan* 2294; Komgha district: Komgha, *Flanagan* 2319; Cala district: *Kolbe* and *Pegler* 1740; Griqualand East: Clydesdale, *Tyson* 1220, 1260, 2526.

NATAL.—Drakensberg, Giants Castle, *Wylie* (*Wood* 10674); Polela, *Evans* 659; Mahwaqua Mountains, *Evans* 225; Lidgetton, *Wood* 6320; Byrne and Richmond, *Wood* 1847; Maritzburg, *Hutton* 315; Umgeni, *Cooper* 1148; Umkomaas, *Wood*; Zuurberg, *Wood* 338.

TRANSVAAL.—Lydenburg district: Elandspruitberg, *Schlechter* 3889, *Pegler* 1740 is probably from Kentani.

41. **P. venusta** E. and Z.

A. suffruticose. *Stems* flexuous, appressedly pubescent. *Leaves* trifoliolate, stipulate, sub-sessile; leaflets 2·5 cm. long, 6–7 mm. broad, cuneate-oblong, obtuse, mucronulate, pellucid-dotted, appressedly puberulent. *Stipules* subulate. *Inflorescence* terminal and axillary, spicate, cylindric. *Peduncle* and spike up to 4 cm. long. *Bracts* subtending flowers half as long as the calyx. *Calyx-tube* 6 cm. long, silky canescent, lobes lanceolate, acuminate, glandular; lowest lobe longest, nearly equalling the petals.

CAPE.—Malmesbury district: Saldanha Bay, *Ecklon* and *Zeyher* 1553.

Description taken from "Flora Capensis." No specimen seen.

42. **P. hirta** Linn.

A branched shrub. *Stems* erect, rigid, canescent with appressed short hairs, sparsely leafy. *Leaves* trifoliolate, petiolate, stipulate; petioles not exceeding 5 mm. long; leaflets 0·5–1·5 cm. long, 4–9 mm. broad, cuneate, obovate, recurved-mucronate, canescent, glandular. *Stipules* adnate to the base of the petiole, small, subulate. *Inflorescence* axillary or in interrupted spikes. *Flowers* in whorls of three, sessile, bracteate. *Calyx-tube* 3–4 mm. long, 6–7 mm. in diameter, glandular, villous; lobes slightly unequal, 1–5 mm. long, 0·75–2 mm. broad, linear-lanceolate to lanceolate-ovate, acute, villous, pilose on the inner surface. *Vexillum* 5–7 cm. long, 4 5 mm. broad, obovate, with a claw 1–3 mm. long; alae 4–6·5 mm. long, 1–2·5 mm. broad, with a linear claw 3 mm. long; carina 3–4 mm. long, 1–2 mm. broad, with a linear claw 3-4 mm. long. *Ovary* glabrous or hirsute; style 3–4 mm. long, glabrous or hirsute.

Flowers: October-November.

CAPE.—Tulbagh district: Winterhoek, *Zeyher*; Cape district: Blaauwberg, *Zeyher*, near Milnerton, *Forbes* 229 · without locality, *Bolus* 2993; Stellenbosch district: Stellenbosch, *Ecklon* and *Zeyher*, Somerset Strand, *Rogers* 17675; Paarl district: Paarlberg *Drege*; Caledon district: Sir Lowry's Pass, *Bolus* 9195.

43. **P. stachydis** L.f.

A branched shrub. *Stems* erect, rigid, villous, with spreading rusty hairs, becoming glabrous when older. *Leaves* trifoliolate, petiolate, stipulate; petioles up to 3 mm. long; leaflets 0·5–2·5 cm. long, 0·4–1·5 mm. broad, obovate, acute or obtuse, hirsute, recurved mucronate, glandular. *Stipules* adnate to the base of the petiole, subulate. *Inflorescence* axillary and terminal, in laxly flowered spikes. *Peduncles* up to 5 cm. long. *Flowers* in whorls of three. *Bracts* small. *Calyx-tube* 3–4 mm. long, 6 mm. in diameter, villous, glandular; lobes ovate-acuminate or sub-lanceolate, villous, glandular, glabrous or sparsely pilose on the inner surface; upper and lateral lobes 2–4 mm. long, 0·5–1·5 mm. broad; lowest lobe 3·5–5 mm. long, 1·5–2 mm. broad. *Vexillum* 7 mm. long, 5–7 mm. broad, obovate, with a linear claw 1–3 mm. long; alae 5·5–6·5 mm. long, 2–3 mm. broad, with a linear claw 3–4 mm. long; carina 3–4 mm. long, 1·5–2 mm. broad, with a linear claw 3–4 mm. long. *Ovary* thinly pilose or glabrous; style 4–5 mm. long, glabrous.

Flowered: October.

CAPE.—Piquetberg district: Piquetberg, *Bolus* 3458, 7529; Cape district: Table Mountain, *Zeyher*.

44. **P. spicata** L.

A shrub. *Stems* erect, virgate, pubescent, glabrescent, glandular, leafy. *Leaves* trifoliolate, petiolate, stipulate; petioles up to 4 mm. long; leaflets up to 3 cm. long, 9 mm. broad, obovate or obovate-oblong, obtuse, recurved mucronate, thickly nigro-punctate, slightly hirsute, especially along the mid-rib and veins. *Stipules* adnate to the base of the petiole, up to 5 mm long, subulate, acute, glandular. *Inflorescence* terminal, sessile, a

densely flowered spike. *Bracts* small. *Calyx-tube* 3–4 mm. long, 5–8 mm. in diameter, veined, pubescent, glands few; lobes lanceolate-ovate, acute, long ciliate, more thickly glandular than the tube, shortly pilose on the inner surface; upper and lateral lobes 1·5–3·5 mm. long, 1–2 mm. broad; lowest lobe 3–5 mm. long, 1–2 mm. broad. *Vexillum* 4–6 mm. long, 4·5–5 mm. broad, obovate, slightly geniculate, with a channelled claw 2 mm. long; alae 3·5–6 mm. long, 1·5–2 mm. broad, with a linear claw 2·5–3 mm. long; carina 2–3 mm. long, 1–1·5 mm. broad, with a linear claw 3 4 mm. long. *Ovary* glabrous; style 3 4 mm. long, glabrous.

Flowered: September–February. Flowers: Colour, pale blue. Plants about 2-3 feet high.

Cape.—Cape district: Capetown, *Bolus* 1429, near "Protea," *Bolus* (*Herb.* 7101), Wynberg, *Bolus* (*Herb.* 7101B), Table Mountain, *Zeyher* (?) (Ex. Herb. Gub.); Paarl district: French Hock, *Phillips* 1091; Swellendam district: Swellendam, *Zeyher* 2374; Riversdale district: Riversdale, *Muir* 83; George district: George, *Paterson*; Knysna district: Forest Hill, *Duthie* 740, Plettenberg Bay, *Ecklon* and *Zeyher* 1546; Albany district: Zuurberg, *Schlechter* 5702, Hofman's Bosch, *Britten* 1028; East London district: East London, *Rattray* 186; Komgha district: Komgha, *Flanagan* 403.

45. **P. racemosa** Thb.

A suffruticose. *Stems* flexuous, slender, pubescent, becoming more or less glabrous, glandular, leafy. *Leaves* trifoliolate, shortly petiolate, stipulate; petioles up to 2·5 mm. long; leaflets up to 1·8 cm. long, 8 mm. broad, cuneate-oblong, flat, obtuse, mucronulate, coriaceous, hispidulous, glabrescent, nigro-punctate, especially near the margins. *Stipules* up to 4 mm. long, subulate, veined. *Inflorescence* terminal, interrupted or axillary. *Flowers* sessile, 2 3 together. *Calyx-tube* 3 mm. long, 5 mm. broad, veined, glands few, translucent, hispid along veins, otherwise glabrous; lobes linear-lanceolate, acute, ciliate, hispid, glands translucent, shortly hispid on the inner surface; upper and lateral lobes 3·5–4 mm. long, up to 1 mm. broad; lowest lobe 5·5 mm. long, 1·5 mm. broad. *Vexillum* 8 mm. long, 6·5 mm. broad, obovate, with a claw 1·5 mm. long; alae 9 mm. long, 3 mm. broad, with a linear claw 2·5 mm. long; carina 3 mm. long, 2 mm. broad, with a linear claw 3·5 mm. long. *Ovary* glabrous; style 3 mm. long, glabrous.

Flowers: October.

Cape.—Riversdale district: Garcia's Pass, *Bolus* 11264; George district: Langekloof, *Ecklon* and *Zeyher.*

46. **P. hamata** Harv.

A shrub. *Stems* erect, striate, virgate, with a few scattered glands, canescent, becoming glabrous. *Leaves* trifoliolate, sub-sessile, stipulate; leaflets up to 2 cm. long and 1 cm. broad, obovate, obtuse, recurved-mucronate, thickly glandular, canescent when young, becoming glabrous. *Stipules* up to 2·5 mm. long, subulate, acute. *Inflorescence* terminal, spicate, sessile. *Calyx-tube* 3 mm long, 7 mm. in diameter, glandular, canescent; lobes ovate, acuminate, glandular, canescent, shortly pilose on the inner surface; upper and lateral lobes 1·5–3 mm. long, up to 1·5 mm. broad; lowest lobe 4 mm. long, 2 mm. broad. *Vexillum* 5 mm. long, 4·5 mm. broad, obovate, with a channelled claw 2·5 mm. long; alae 4·5 mm. long, 2 mm. broad, with a linear claw 3 mm. long; carina 3 mm. long, 2 mm. broad, with a linear claw 4 mm long. *Ovary* pilose; style 4 mm. long. *Pod* membraneous, pubescent, with persistent calyx; seed small, hard and brown.

Flowered: January.

Cape.—Worcester district: Hex River, near De Doorns, *Bolus.*

Namaqualand Minor.—Without precise locality, *Scully* 1137.

47. **P. Wilmsii** Harms.

A tall shrub. *Stems* thinly pubescent, leaves 2–3 cm. equidistant. *Leaves* trifoliolate, petiolate, stipulate ; petioles up to 4 mm. long ; leaflets up to 4·5 cm. long and 1·3 cm. broad, oblanceolate to oblanceolate-ovate, obtuse, recurved mucronate, nigro-punctate, thinly pubescent, becoming glabrous, sessile or sub-sessile. *Stipules* lanceolate, acuminate, glandular, thinly pubescent. *Inflorescence* terminal and axillary, spicate. *Peduncles* up to 2·8 mm. long. *Flowers* in threes subtended by a common bract. *Calyx-tube* 2·5 mm. long, 5·5 mm. in diameter, veined, glandular, hirsute ; lobes ovate, glandular, hirsute, ciliate, hirsute on the inner surface ; upper and lateral lobes 1·5–2 mm. long, up to 1 mm. broad ; lowest lobe 2·5–3 mm. long, 1–1·5 mm. broad. *Vexillum* 6–6·5 mm. long, 5·5–6 mm. broad, ovate or obovate, with a linear claw 1·5–2·5 mm. long ; alae 6 mm. long, 2–2·5 mm. broad, with a linear claw 2·5–3 mm. long ; carina 3–4 mm. long, 1·5–2 mm. broad, with a linear claw 3–3·5 mm. long. *Ovary* pubescent ; style 3·5–4 mm. long, pilose.

Flowers : July–January.

TRANSVAAL.—Zoutpansberg district : The Downs, *Rogers* 20209 ; Lydenburg district : Elandspruitberg, *Schlechter* 3889 ; Ermelo district : Mavierstad, *Pott* 5086.

SWAZILAND.—Without precise locality, *Bolus* 11794.

48. **P. striata** Thb.

A virgate shrub. *Stems* erect, striate, leafy, canescent. *Leaves* trifoliolate, petiolate, stipulate ; petioles not exceeding 5 mm. ; leaflets 0·7-3·5 mm. long, 0·4-1·7 cm. broad, obovate to obovate-oblong, recurved mucronate, nigro-punctate, thinly canescent, becoming almost glabrous when older. *Stipules* lanceolate. acute, nigro-punctate, canescent. *Infloresecence* terminal and axillary, spicate. *Spikes* sometimes lax and interrupted. *Peduncles* up to 2·5 cm. long. *Calyx-tube* 2·5–4 mm. long, 6 7 mm. in diameter, glandular, canescent ; lobes ovate to lanceolate-ovate, acute, glandular, canescent, glabrous or pilose on the inner surface ; upper and lateral lobes 1-3 mm. long, 0·75–1·5 mm. broad ; lowest lobe 1·5–5 mm. long. *Vexillum* 6 7 mm. long, 4 5 mm. broad, obovate, with a claw 1 3 mm. long ; alae 4–5 mm. long, 1·5 2 mm. broad, with a linear claw 3 4 mm. long ; carina 3–4 mm. long, 1·5–2 mm. broad, with a linear claw 3 4 mm. long. *Style* 3-4 mm. long, pilose or glandular. *Pod* membraneous, 1·4 cm. long, 4 mm. broad, pubescent, with the persistent calyx ; seed up to 1 cm. long, hard and brown.

CAPE.—Clanwilliam district : Olifant's River, *Zeyher* 1556 . Swellendam district : Gauritz River, *Zeyher* 1551 ; Oudtshoorn district : Oudtshoorn, *Britten* 134.

Var. *gracilis*. Plant more slender and laxly leafy. Flowers fewer and smaller, 1–3 subtended by a common bract. Flowers on long terminal rhachi.

NAMAQUALAND.—Between Brakdam and Rietkloof, *Pillans* 5667.

49. **P. Royffei** n. sp.

Stems striate, younger parts clothed with yellowish pubescence. *Leaves* trifoliolate, petiolate, stipulate ; petioles up to 6 mm long ; leaflets up to 2·3 cm. long and 1·3 cm. broad, elliptic-lanceolate to elliptic-obovate, mucronulate, densely nigro-punctate, pubescent on lower surface. *Stipules* up to 5 mm. long, subulate, acute, glandular, pubescent. *Inflorescence* terminal, spicate. *Peduncles* up to 1 cm. long. *Flowers* sessile or very shortly pedicelled, 2–3 together subtended by a bract. *Calyx-tube* 2·5 mm. long, 6 mm. in diameter, pubescent, glandular ; lobes acute, pubescent, ciliate, glandular, pilose on the inner surface ; upper and lateral lobes 2·5-3 cm. long ; lowest lobe 4 mm. long, 1·5 mm. broad. *Vexillum* 7 mm. long, 6 mm. broad, obovate with a short claw 2 mm. long ; alae 6·5 mm. long, 2 mm. broad, with a linear claw 3 mm. long ; carina 3·5 mm. long, 2 mm. broad, with a linear claw 3·5 mm. long. *Ovary* pilose ; style 3 mm. long, pilose.

Flowered : October. Flowers : Yellow.

CAPE.—Tembuland, Cala,' *Royffe* 161.

A Drying Cabinet for the Preparation of Plant Specimens for the Herbarium.

By A. P. D. McClean, Natal Herbarium, Durban, and H. H. Storey, East African Agricultural Research Station, Amani.

INTRODUCTION.

The Drying Cabinet, which is described in this paper, is the outcome of our attempt to meet the extreme difficulty of drying plants under the normally highly humid conditions of the Durban climate. By the ordinary plant-press method, the drying is a lengthy process and even by exercising the greatest care the specimens are of poor quality, frequently rendered valueless by the development of moulds.

The general principle of our drier evolved from a conversation several years ago with Mr. G. H. Cunningham, of New Zealand. He is understood to have a machine of similar type in operation, but no description appears to have been published. In view of the interest which many visitors have shown in our drier, it appears advisable to make a description available. We acknowledge our obligation to Mr. Cunningham for the basic idea, though we, in collaboration with the Public Works Department, are responsible for the details of this design.

DESCRIPTION OF THE DRYING CABINET.

The principle of our method of drying is as follows: – The plants to be dried are laid between sheets of drying paper in the customary manner and subjected to a suitable degree of pressure. Hot air is then drawn through the pile, the air passing through the interstices between the sheets.

The cabinet, constructed of stout, well-seasoned teak, consists of a Pressing or Drying Chamber and a cupboard divided by a shelf into two compartments, an upper oven and a lower heating chamber. These features are illustrated in the accompanying photographs and diagrams.*

The Pressing or Drying chamber is 10″ × 1′ 8″ × 1′ high and can accommodate approximately 100 plant specimens of a size suitable for the average mounting sheet. This chamber is fitted with a lid consisting of a flat base with an attached letterpress screw and screw block. The latter is maintained in a fixed position by means of a slotted arm which fits over two hold-fasts screwed to the sides of the chamber. By this means the lid can be lowered or raised at will. In addition the lid has certain features to procure as nearly as possible an air-tight joint with the sides of the chamber. Pieces of solid rubber beading of the desired length are held in movable steel holders attached by means of slotted iron clips to the upper edges of the lid. When the lid is in the desired position, the rubber bead can be made to press firmly against the walls of the chamber by means of 4 pivoted cleats. Triangular pieces of rubber are provided for the corners, the ends of the steel holders and the beadings being cut in such a way as to allow for the fitting of the corner pieces.

* Acknowledgment is made to Mr. L. H. Godfrey, District Draughtsman, Public Works Department, Natal, for the diagram drawings.

The Heating Chamber of the dimensions 10″ × 1′ 8″ × 8″ is asbestos lined and equipped with 3 Revo electric fire-baths, each consuming 500 watts. By means of a 3-way control switch either one, two, or three of the units can be brought into operation. An iron shelf divides the heating chamber from the oven. Access is provided to the cupboard by means of a felt-lined door equipped with a fastening catch bevelled to create pressure on closing. Air is drawn through the system by a Sturtevant ¼ H.P., 2,750 R.P.M. exhausting fan, attached to the side of the drying chamber, communication with which is provided through a narrow vent at its base. Air enters the system through a small opening in the base of the heating chamber—passes over the electric fire-baths, through an opening in the cupboard shelf and enters the drying chamber through five holes in the roof of the oven, at the end opposite to that carrying the fan. Hot air therefore enters the drying chamber at this end and is drawn by the fans horizontally through the pile of drying papers and plants, which lie compressed between the base of this chamber and the screw-down lid. Temperature is observed by means of a thermometer which passes through the wall of the cabinet into the oven at the point where the air enters the drying chamber.

PROCEDURE.

The plant specimens are arranged in the usual way between sheet of some absorbent material such as blotting paper : three sheets between each has been found generally suitable, The sheets are cut 10″ wide so as to fit exactly into the drying chamber. A fairly high degree of pressure can be maintained on the specimens without seriously retarding the passage of air through the system. The fan is then set in motion and the heating switch turned to high. In this position the temperature measured by the thermometer already mentioned rises to about 150° C. after an hour. The switch should then be turned to medium which maintains the system at a temperature between 130° C. and 150° C. It is not desirable to keep the three heating units in action for long periods as this will tend to cause over-heating, the specimens becoming brittle and crumbling when handled. A drying temperature of about 130° C. to 140° C. seems to be the most satisfactory. The switch may be turned to low after four or five hours.

The average plant specimen of a woody nature and not of an unduly high degree of succulency requires about an 8-hour treatment. Delicate herbs can be dried in under four hours, while excessively succulent plants of the Aloe type require up to 16 hours.

For seaweeds a low temperature is recommended and we have found it advisable to keep the switch at low, as high temperatures tend to remove the colouring matter.

The oven was included to make provision for the drying of such botanical specimens as fleshy fungi. An excellent result was obtained with a species of Polyporus and complete drying was effected in eight hours at a temperature of 70° C. We have no doubt that many uses will be found for this additional drying chamber.

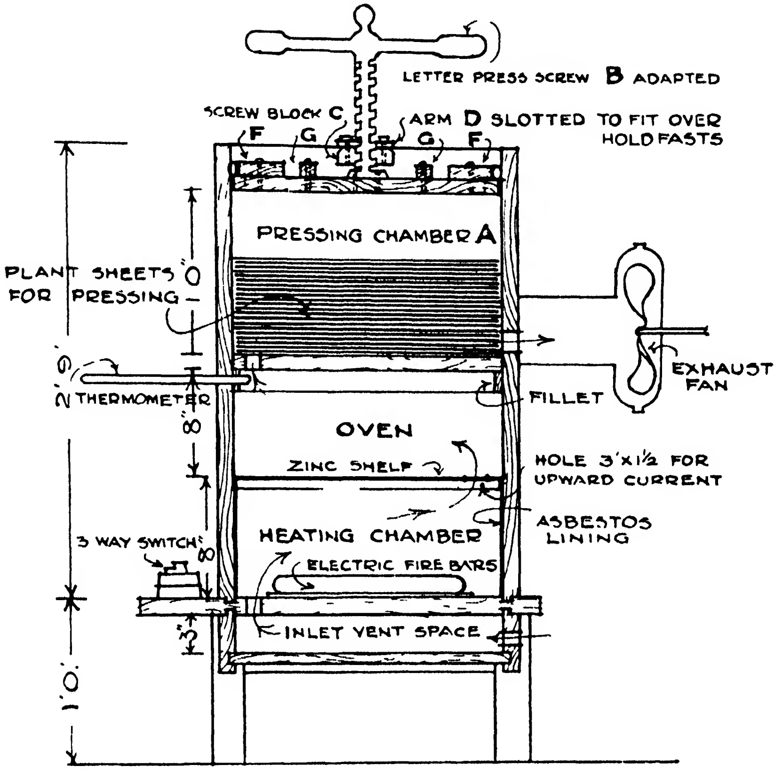
DISCUSSION.

Our method not only provides for the very rapid drying and preparation of herbarium specimens, but yields results of an excellent quality.

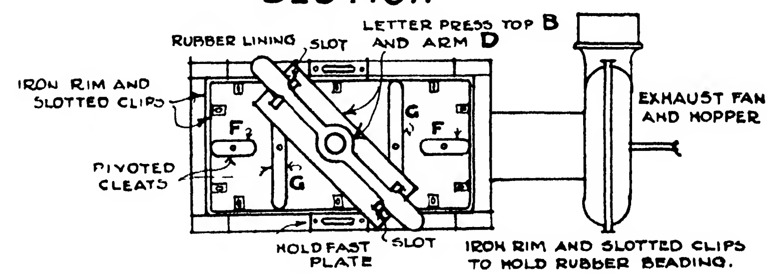
The finished specimens do not possess the brittleness which so frequently is associated with certain plants prepared by the usual slow method of drying. Moreover, colours are retained very much better and there is less vegetative distortion. We have little doubt it will overcome many of the difficulties encountered with some natural families of which the preparation of dried specimens gives normally much trouble

We commend this piece of apparatus to those in charge of Herbaria situated in the Tropics and other regions of high humidity.

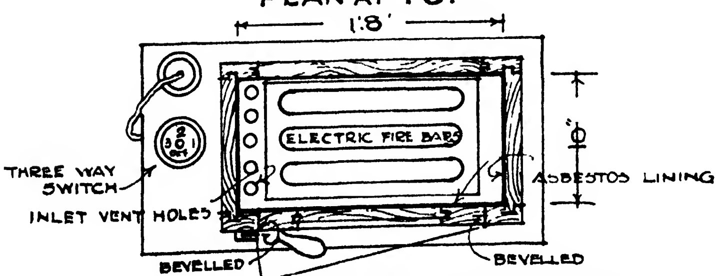
DRYING CABINET



· SECTION ·



PLAN AT TOP



PLAN AT HEATING CHAMBER

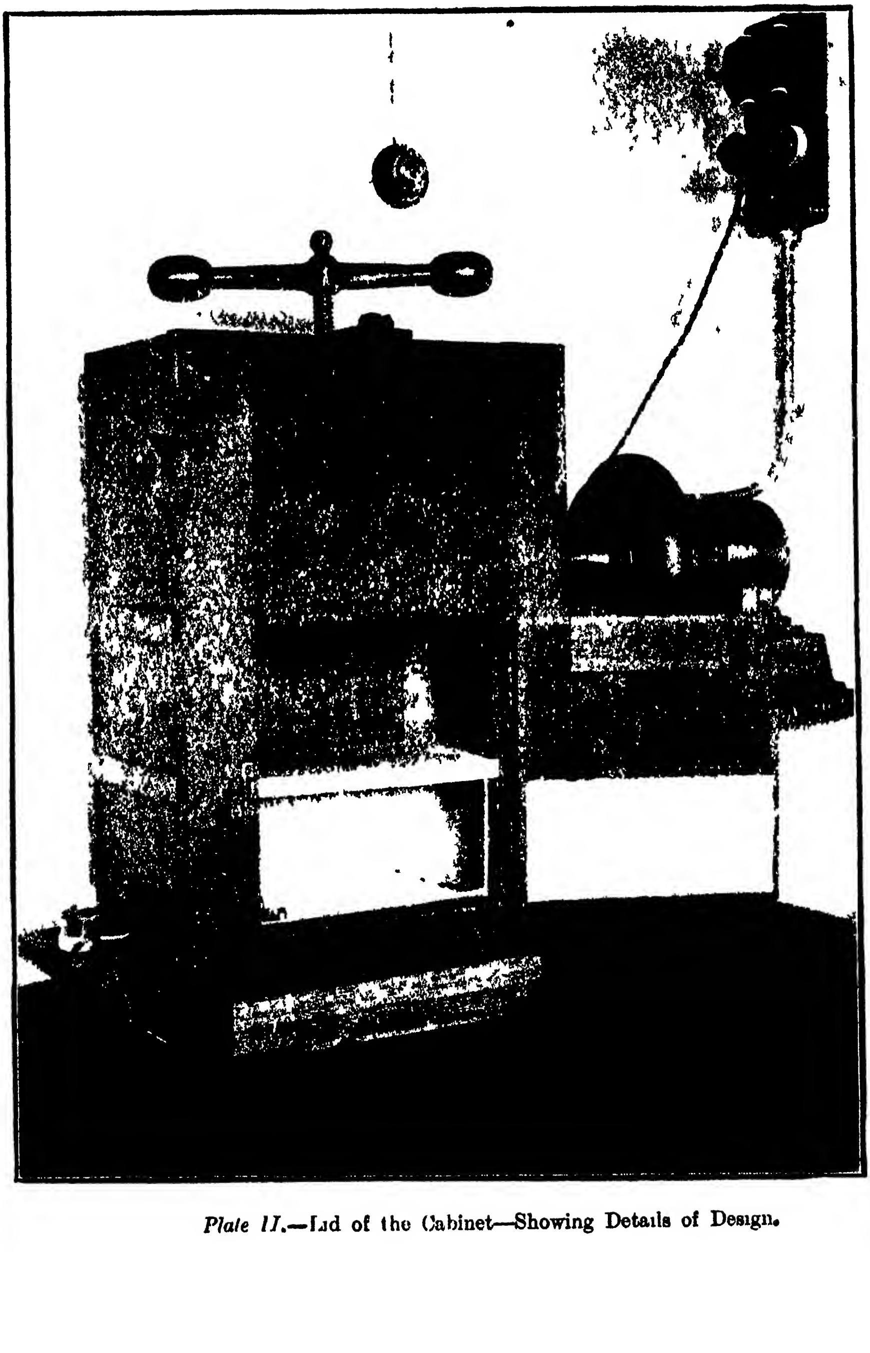
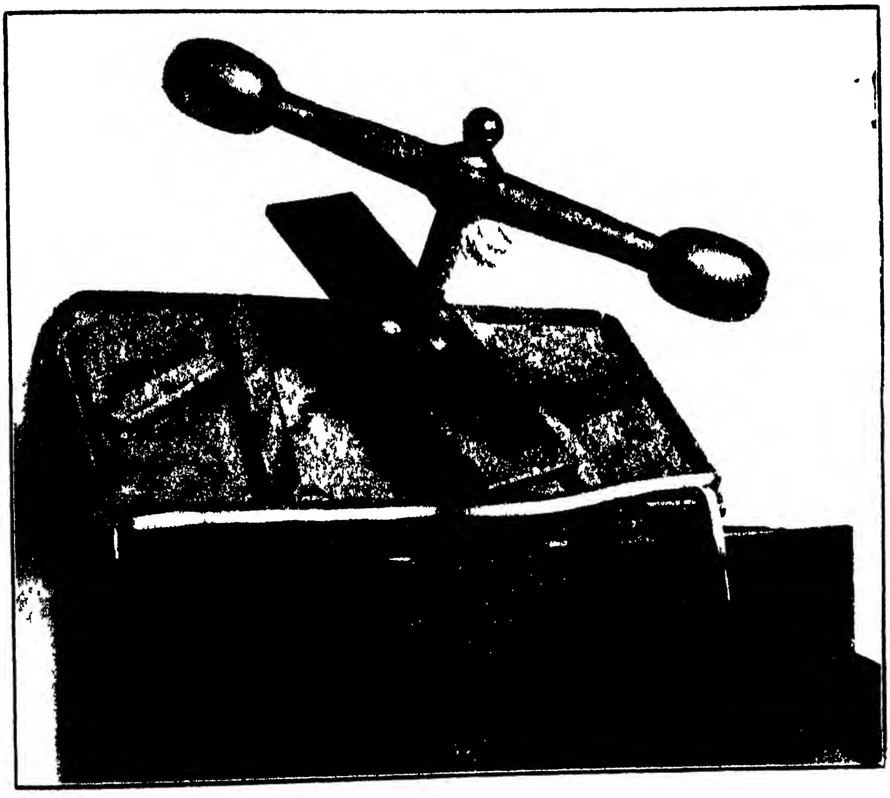


Plate II.—Lid of the Cabinet—Showing Details of Design.



EXPLANATION OF PLATES

Plate I.—Drying Cabinet with the Lid in Position

Notes on *Aloe spicata* Linn. fil.

By R. Marloth.

The identification of our older species of Aloe from descriptions and illustrations has offered many difficulties, for nearly all these diagnoses were based upon plants cultivated in European conservatories, that means, they had grown up in an environment with a considerably moister atmosphere and a far less sunny climate. Under such conditions these highly succulent plants generally assume quite a different habit, not only in stem and foliage, but also in the nature of their inflorescence. Consequently when Volume VI of the Flora Capensis appeared in 1897 comparatively few of our wild species of Aloe were known correctly by name, although some of them had been in cultivation in Europe for two centuries. They differed to such an extent from the available descriptions that recognition became possible only through a study of plants from various localities and of their behaviour under cultivation in our gardens. A few of the species of which the natural home was not known 25 years ago are the following: —*Aloe succotrina*, *A. purpurascens*, *A. microstigma*, *A. obscura*, *A. glauca*, *A. falcata*, *A. grandidentata*, *A. pluridens*, *A. Salm-dyckiana* and the subject of this article, viz. *A. spicata*. For all these, with the exception of the last named, the difficulties and doubts have been gradually overcome, and we are now fairly certain of their identity and localities of occurrence in the country.

With regard to the last one in the list, viz., *A. spicata*, the writer considers that he has at last solved this puzzle, for Linnaeus' *Aloe spicata* is the plant now usually called *A. speciosa*.

Before discussing the reasons for this conclusion it appears advisable to quote the descriptions of *Aloe spicata*, as given in the three principal publications dealing with the plant, viz.:

Linnaeus fil. Supplementum, 205 (1781).

Thunberg, Flora Capensis, Edit. Schultes, page 309 (1823).

J. G. Baker, Flora Capensis, Vol. VI, page 316 (1896).

Linnaeus fil. Supplementum, 205 (1781).

"*Aloe spicata.* Caulescens, foliis planis, ensiformibus, dentatis, floribus spicatis, campanulatis, horizontalibus."

Thunberg in Flora Capensis, Edition Schultes, page 309 (1823).

"Crescit in Promontorii Bonae Spei interioribus regionibus. Floret Augusto."

"Caulis teres apice foliosus, 3–4 pedalis, crassitie brachii. Folia subverticillata, carnosa, basi lata sensim attenuata, canaliculata, dentibus remotis, patentia bipedalia. Flores densissime approximati horizontaliter patentes; spica pedalis sensim florens. Bractea sub singulo flore solitaria ovata acuta lata membranacea alba, striis 3 viridibus, corolla paulo brevior. Corolla subhexapetala; laciniae 3 interiores invicem non connatae, latiores, ovatae, obtusae, albae, carina linea triplici viridi, unguiculares; tres exteriores basi cum interioribus connatae, angustiores, ceterum similes, minus concavae. Filamenta linearia sensim parum attenuata, basi alba, superne flavescentia, inaequalia, erecta, corolla sesquilongiora. Antherae ovatae, incumbentes, fulvae. Stylus flexuosus erectus, longitudine fere staminum. Stigma simplex obtusiusculum. Capsula ovata, obtusa, subtrigona, inflexa, hinc carinata, lateribus planis quadristriata, inde convexa sulco medio glabra. Dissepimentum duplicatum. Corollae repletae succo melleo purpurascente."

Baker in Flora Capensis, Vol. VI, page 316 (1896).

A. spicata Linn. fil.

"Stem elongated below the leaves, simple; leaves 12–20, laxly disposed, patent or the lower recurved, ensiform, 18 inches long, $1\frac{1}{2}$ to 2 inches broad low down, 6 lines thick in the centre, tapering gradually from the middle to a long point, green with a slight glaucous tinge, obscurely lineate towards the base, mottled with copious irregular whitish oblong spots; margin with spreading, horny, deltoid-cuspidate prickles $1\frac{1}{2}$ to 2 lines long; peduncle slender, simple or forked, above a foot long; raceme oblong, 6 inches long; pedicels ascending, 6–9 lines long; bracts small, lanceolate; perianth bright yellow, tinted with red when young, 15 lines long, tube short: stamens slightly exserted."

A comparison of these accounts shows that they cannot refer to the same species, and as Mr. Baker states that his description of the flower was taken from a plant cultivated by Mr. Peacock (1879), it is obvious that that plant had been wrongly named, and that Haworth, whom Baker followed otherwise, had also erred in applying Linnaeus' name to a plant with speckled leaves, for neither Linnaeus nor Thunberg mention the spots on the leaves, which they could not have overlooked, nor does the latter call the inflorescence forked and the flowers yellow. The erroneous views of these authors are probably the principal cause which has prevented the recognizing of the true *A. spicata* up to the present.

A further proof that Haworth and Baker were mistaken in their identification is afforded by Mr. N. E. Brown's study of Thunberg's type specimen collected by him about the year 1776 and preserved in his herbarium at Upsala. Mr. Brown's account is published in Bothalia, Vol. I, page 142 (1922), and runs as follows (omitting his comments):—

A. spicata Linn. fil., ex Suppl. p. 205 (1781), and Thunb. Flora Capens., page 309.

"Thunberg's specimen is the type of this species and consists of portions of two leaves and six detached flowers. The leaves are resp. $10\frac{3}{4}$ and $13\frac{3}{4}$ inches long and 14 and 16 lines wide at their basal ends, gradually tapering thence into a long and slender subulate point which at 3 inches below the acute or bluntish tip is only 2 lines broad. . . . The teeth on the margins are 6–8 lines apart and very small, being not more than half a line long; the apical spine is also small. The margin between the spines is straight or very faintly concave. The flower stem and pedicels are absent, but the flowers may have been sessile. One flower has what appears to be a bract attached to it, which is 6 lines long and 5 lines broad, and is broadly elliptic, obtuse, 3-nerved. The perianth is campanulate in shape, 7 lines long and 5 lines in diameter as pressed, but is probably of nearly the same dimensions when alive. The segments are nearly 3 lines broad, ovate-oblong, obtuse, 3-nerved; they all appear to be free to the base and are not recurved at the apex. According to Thunberg they are white, with three green veins. The stamens are exserted 3–4 lines beyond the tips of the perianth segments with stout purple filaments half a line broad."

It will be seen that—

1. The leaves of the type are not mottled.

2. The marginal prickles are "very small, being not more than half a line long," while Mr. Baker's plant had "spreading, horny, deltoid-cuspidate prickles $1\frac{1}{2}$ to 2 lines long."

It is obvious that Mr Baker's statements cannot be reconciled with Thunberg's and Brown's descriptions.

Having recently had occasion to study a population of hybrids* between *A. ferox* var. *supralaevis* and *A. speciosa* Baker, and comparing them with living material of both parents from various sources, the writer noticed that Baker's description of his *A. speciosa* agreed remarkably well with Mr. Brown's description of Thunberg's type specimen of *A. spicata*, and combining this account with Thunberg's own diagnosis it became obvious that Baker's *A. speciosa* was *A. spicata* Linn. fil.

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* The hybrid has been named *A. Tomlinsonii* and is figured and described in *South African Gardening*, October, 1929.

Aloe spicata L. fil. and *A. ferox*. Hillside at Alicedale. August. The plant in the foreground and the others with deflexed leaves and simple spike or spikes are *A. spicata*; those with stiffly erect leaves and branched inflorescence are *A. ferox*. [*Photo by* R. Marloth.

Aloe spicata L. fil. Hillside near the Breede River, 15 miles south of Swellendam. Nearly all the older plants here are branched at the top and bear several spikes. August.
[*Photo by* L. L. Tomlinson.

Baker's description of *A. speciosa* (Flora Cap., Vol. VI, 323), taken over from the *Journ. Linn. Soc.* XVIII, 178), is as follows:—

"Habit of *A. africana*, reaching a height of 20–25 feet; leaves in a dense rosette, 15–18 inches long, 2 inches broad low down, ensiform, glaucous, with smaller and weaker prickles than *A. africana*; peduncle short, stout, simple; raceme very dense, simple, a foot long, 4 inches in diameter when expanded, all except the upper flowers deflexed, pedicels 2–3 lines long; bracts sub-orbicular, obtuse, 6 lines long and broad; perianth cylindrical, 15 lines long, rose-tinted in an early stage only, greyish white when mature: tube scarcely any; stamens and style bright red, conspicuously exserted." Somerset East, MacOwan No. 1922.

Note by the Writer.—*A. speciosa* is quite different in habit from *A. africana*, and never reaches a height of 20 feet. The only similarity would be that both are arborescent, with a trunk 6 to 10 feet high, but so are quite a number of others. The perianth, when fresh, is always more or less clavate and constricted at the mouth, as shown very well in Berger, Aloineae Das Pflauzenreich, page 300.

If one remembers that Baker's description was drawn up from a dried specimen, and if one corrects the statements about similarity to *A. africana* and the height of the plant, which are erroneous as every one who knows the fairly widely distributed *A. speciosa* Baker will confirm, this description of *A. speciosa* agrees very well with Thunberg's type of *A. spicata*, as redescribed by Mr. Brown.

There are, however, a few minor points in Thunberg's description of the flower which call for special consideration.

1. The bracts are described as "little shorter than the flowers," while in *A. speciosa* they are about one-third the length of the fully developed flowers.

2. The filaments are described by Thunberg as "white at base and yellowish higher up," while in *A. speciosa* they are yellowish at the included part and dark brown or purplish brown in the projecting part.

3. The nectar in the flowers is said to be purple, while it is colourless or yellowish in fresh flowers of *A. speciosa*.

The discrepancy concerning the bracts has been disposed of by Mr. Brown's account of Thunberg's type specimen.

With regard to the colour of the filaments Mr. Brown finds that in the type they are purple . . . whatever their original colour may have been.

On the third point I have made an observation which disposes of that as well, viz.: if older fresh flowers are placed between paper, the nectar, if there is any, although originally colourless, soon dissolves the pigment of the filaments and stains the paper purple while the filaments themselves become paler.

Taking all these observations together and considering the unusual colour of the perianth, viz.: white with green lines, there is no point left that would be inconsistent with the view that *Aloe speciosa* Baker is *Aloe spicata* Linn. fil.

It is noteworthy that Berger's studies of these plants had led him to the conclusion that "Haworth's identification was probably wrong and that *A. spicata* has its nearest ally in *A. speciosa* Baker." (Aloineae, page 301). The foregoing discussion will show that we have to go a step further and consider them to be synonymous.

After the foregoing note on *Aloe spicata* had been written Dr. Pole Evans drew my attention to an article in the Gardener's Chronicle of June, 1921, page 6, by Mr. N. E. Brown of Kew, on *Aloe spicata*. In this article I find the following passages quoted by the author:

(*a*) From Thunberg's dissertationes on Aloe: "*the purest and best juice of aloes is obtained from this species.*"

(*b*) From Linnaeus fil. Supplementum, page 205 (1781): "*from the juice of this species the best gum-resin of aloes is prepared, from the rest of the species the cheaper kinds.*"

Obviously Linnaeus had merely repeated the information received from Thunberg, but it should be noted that Thunberg has omitted this statement from his Flora Capensis—perhaps it had been recognized in the meantime as erroneous. Whether the drug or some variety of the drug was ever prepared from this species on a commercial scale or not does not concern us here. The importance of the statement is in the fact that Thunberg's specimen must have come from a district where the drug aloes was being manufactured—and that information settles the point at issue, for when Thunberg stayed at the Cape (1775) such manufacturing was carried out only in the Swellendam district which then embraced also the country now forming the districts of Riversdale and Mossel Bay, and in that area occur only two species of tree aloe, viz., *Aloe ferox* and *A. spicata* (*A. speciosa*). That the other kind "*from which the cheaper quality of aloes was obtained*" is *A. ferox* is now generally admitted. In fact, at present no other species is used at all for this purpose, and it is remarkable that the farmers in those districts call *A, ferox* simply the " alwij," while *A. spicata* is one of the " wilde alwij," because it cannot be used for the manufacturing of the drug. Whether 150 years ago some attempts were made to prepare a different kind of drug from *A. spicata* as well as from *A. ferox*, or whether Thunberg's informant confused the two species could hardly be elucidated at the present time. It should be remembered that Thunberg did not see the plant in its wild state, for he merely states that it grows in the interior, which means anything beyond Stellenbosch. He must have obtained his specimen either from a garden at Capetown or it was sent to him by a correspondent.

Postscript.—When writing the foregoing notes for publication in Bothalia I sent an illustration of the hybrid *Aloe Tomlinsonii* to South African Gardening, where it appeared in November, 1929, with the following footnote :- -

" The plant described by Baker in 1880 under the name *A. speciosa* and now generally known as such has been recognized to be identical with speciments described by Linnaeus the younger and Thunberg as *A. spicata*, hence the former name becomes a synonym for the latter. The reasons for this change of name will be given in the forthcoming number of Bothalia (Pretoria, 1929.) "

The view on *Aloe spicata* expressed therein is contradicted by Mr. N. E. Brown, Kew, in a letter to the Editor of S.A. Gardening, published in the May number, 1930, of that journal, just at the time when the proof of the foregoing article reached me. I cannot help expressing my regret that Mr. Brown, a highly esteemed friend, should have rushed into print instead of awaiting the appearance of my notes, of which he had notice, for he does not put forward any new observation and merely reiterates what he published 8 to 10 years ago and what is quoted above.

His statement in that letter : " the two species have not the slightest resemblance to one another " is in direct conflict with Berger's view that : " *Aloe spicata* has its nearest ally in *Aloe speciosa* Baker " (Aloineae, page 305),* especially if one remembers that this author based his conclusions on plants grown and flowered by him at La Mortola year after year and not only on herbarium specimens, as Mr. Baker and Mr. Brown had to do.—R.M.

* See Das Pflanzenreich, IV, 38, III, 2. Liliaceae-Aloineae (1908.)

South African Gramineae.

Some new species of Digitaria.

By Sydney M. Stent.

The following species and varieties of *Digitaria* with the exception of *D. apiculata* and *D. trichopodia* have been described from living plants that were collected from many different and widely separated localities in the Union of South Africa and brought to the Government Experiment Station Prinshof at Pretoria where they have become well established. There is a pure stand of each grass of about 1/40 acre in size so that in describing the species I have been able to study a very large number of plants of each.

I have found it exceedingly difficult, in many cases to describe the grasses so that they may be recognized from the herbarium sheet, in the field the differences, especially in the vegetative habit, are so marked that it is impossible to class them as one species, but on the sheet naturally these characters are not so obvious, and I am not surprised that systematists who have only had dried material with which to work have classified most of these grasses under *D. eriantha* adding forma or var. to account for any variations observed. As it is I have only, out of the mass of material studied—some 60 separate stands—classified 16 as distinct species of which 11 are new, although the Agriculturist claims that no two stands are exactly alike and has given to each grass its distinguishing vernacular name.

In most cases the distinguishing characters of the inflorescence are very slight. I find the size of spikelets and degree of hairiness very variable, within certain limits, in each species and one must depend on a correlation of characters rather than on any specially outstanding character in determining the species.

A detailed account of all the *Digitarias* at Prinshof with their agricultural and grazing value will appear in another publication.

The letters N.H.P. before a number signify National Herbarium, Pretoria.

D. Pentzii.

Perennial, densely tufted, much branched from the crown with intravaginal innovation shoots, sending out numerous surface runners or stolons bearing dense fascicles of short upright or spreading shoots from the rooting nodes, internodes glabrous or hirsute, often reddish. *Flowering culms* erect or sub-geniculate 3—7 noded, the lower internodes short and usually included, the uppermost long exserted and equalling half or more the length of the culm which reaches a height of about 120 cm.; *leaf sheaths* rather loose, the upper glabrescent, the lower hairy with rather long fine hairs, densely and appressedly silky hairy at the base, compressed, up to 14 cm. long; *ligule* membranous, broadly rounded to truncate, often denticulate, up to 5 mm. long; *blades* linear from a slightly narrowed base tapering to a long very narrow apex, up to about 30 cm. long by 6mm. broad, minutely and softly hairy above and below or quite glabrous or with a few scattered long white hairs, scaberulous on both sides but more so on the under side, midrib raised in a prominent keel below, grooved above, primary nerves about 5 on either side, not prominent. The leaves of the stolon shoots are usually shorter and broader. *Racemes* about 3–12 and about 17 cm. long, strictly umbelled or sub-digitate on an elongated axis up to 3 cm. long terminating in 1, 2 or 3 racemes; *rhachis* triquetrous, narrowly winged, ·5 mm. wide, scabrid on

the margins and on the facial angle, glabrous ; *pedicels* 2-nate, rarely 3-nate, triquetrous, scabrid, the longer about 2 mm. long, lower about ·5 mm., glabrous ; *spikelets* imbricating, 3–3·5 mm. long and up to 1 mm. wide, narrow lanceolate acute ; *lower glume* reduced to an ovate rounded or truncate nerveless scale ; *upper glume* equalling about ⅗ the length of the spikelet, 3-nerved with dense lines of rather long straight fine blunt hairs between the nerves and on the margins, the marginal extending beyond the tip ; *lower valve* the size of the spikelet, 7-nerved, nerves smooth, the inner lateral nerves rather close with dense lines of soft fine blunt hairs between them and on the margins, hairs often ultimately spreading and up to 1 mm. long ; *pale* and *lodicules* up to ·3 mm. long ; *fertile floret* slightly shorter than the lower valve, narrow lanceolate acuminate, thinly chartaceous.

TRANSVAAL : Zoutpansberg ; Mara, Kligoblin, *Archer* 18 ; Downs *Junod* 4086 : Elim Mill, *Thomas* 9, 4 and 3 ; Manner Mead, *Daire N.H.P.* 8376 ; Messina, *Turner* 25, 17 ; *Pole Evans N.H.P.* 8496 ; Pietersburg *McKechnie, N.H.P.* 7913 ; Pretoria District : Pretoria *Pentz N.H.P.* 8044, 8051, 8560, 8550, 8554, 8521, 8051 ; Kaalfontein, Wilfontein Farm, *Bevan, N.H.P.* 7602 ; Hamanskraal *Tregenna* 201, *Pearce, N.H.P.* 7958 ; Vastfontein, *Liebenberg N.H.P.* 7955 ; Rustenburg District : Verdun, *Cellier, N.H.P.* 7910 ; Marico District : Malmanie Oog, Ottoshoop, *Liebenberg, N.H.P.* 7966 ; Wolmaransstad ; Boskuil, *Sutton* 108 ; Standerton District : Balfour, *Visser, N.H.P.* 8020.

ORANGE FREE STATE : Parys, *Ramsbottom, N.H.P.* 8380.

CAPE PROVINCE : Vryburg District : Vryburg *Pentz, N.H.P.* 8501, 8509, 8510 (type) ; Iffley, *Mather, N.H.P.* 7947 ; Bechuanaland : Vukwe, *Pole Evans and Pentz, N.H.P.* 8493 ; Tati District : Francis Town, *Pentz, N.H.P.* 8521.

var. minor (=*Digitaria eriantha* var. *stolonifera*, Stapf.) rather weaker and more straggling than the type, Racemes 4 or 5 rarely more numerous, usually strictly umbelled, spikelets about 2·5 mm. rather plumper and less acuminate than the type, hairs of the valve often mixed with fine but stiff bristles.

TRANSVAAL : Waterberg : Middelfontein Num-num, *Donisthorpe, N.H.P.* 7864 ; Naboomspruit : Koornpunt, Kalpan, *Langerman, N.H.P.* 8702 ; Palala, *Espach, N.H.P.* 7622 ; Pietpotgietersrust, *Pentz, N.H.P.* 7816, 8513 ; Pyramid Estate, *Galpin* 8874 ; Hangklip, *Knothe N.H.P.* 7960 ; Marico District : Malmanie oog, Ottoshoop *Liebenberg, N.H.P.* 7965 ; Pretoria District : Hamanskraal *Pentz, N.H.P.* 8514 ; Pretoria, Paardefontein, *Liebenberg N.H.P.* 8024 ; *Steyn N.H.P.* 8054.

This species varies considerably within its prescribed limits many of the variations being probably due to hybridisation. This is the well-known " Woolly Finger Grass " of South Africa that has been proved to be such an excellent pasture grass. Specimens of this grass and of other stoloniferous species have been distributed under the name of *D. eriantha* var. *stolonifera* Stapf. but only the one fairly constant variety, *D. Pentzii* var. *minor*, really corresponds to the type of Stapf's variety.

D. valida.

Densely tufted perennial with intravaginal innovation shoots and sending out long rather stout and often repeatedly branched runners, that root and shoot from the nodes, internodes and young shoots hairy. *Culms* glabrous, smooth, subterete, geniculate from about the second node and then erect, stout, up to 130 cm. high, 3–4 noded, simple or more usually branched from one or more of the lower nodes, uppermost internode very long ; *sheaths* of leaves up to 18 cm. long compressed and keeled, the lower loosely hairy all over, densely silky tomentose at the base, the upper glabrescent except at the always hairy nodes, firm, rather loose ; *ligule* delicately membranous, up to 5 mm. long, ovate obtuse, glabrous, minutely denticulate ; *blades* linear lanceolate from a slightly narrowed base, long tapering to a narrow acute apex, 18–50 cm. long by 5–9 mm. wide, firm, flat or lightly folded, glabrous, smooth below, with scabrid margins, midrib grooved above and forming a prominent firm keel below, primary nerves 3–4 on either side the midrib. *Racemes* about 9–14, whorled

or sub-whorled on a short (about 3·5 cm. long), common angled axis, up to 13 cm. long; *pedicels* 2-nate the longer rather less than 1–1·5 mm. long, scabrid, glabrous. *Spikelets* narrow ovate-lanceolate, acute, about 3–5 mm. long ·7 mm. wide, *lower glume* a rather firm minute, membranous scale ; *upper glume* about two-thirds the length of the spikelet, 3-nerved with lines of fine blunt appressed hairs between the nerves and on the margins ; *lower valve* the size of the spikelet, 7-nerved, nerves smooth, rather close, hairs as in the upper glume ; *pale* ·7–1 mm. long, lodicules minute, truncate ; *fertile floret* rather firmly membranous, lanceolate acuminate, slightly shorter than the lower valve.

TRANSVAAL.—Pretoria, *Pentz, N.H.P.* 1970 (*type*) 8506, 8552, *Wager, N.H.P.* 8060 ; Rustenburg, Doornpoort, *Mogg, N.H.P.* 8571 and 8572 ; Marico, Skuinsdrift, *Liebenberg* 564 ; Slurry, *Pole Evans and Pentz, N.H.P.* 8520 ; Malmanie's Oog, *Pentz, N.H.P.* 8512 ; Heidelberg, Uitgevallen, *Burtt-Davy* 13666 ; Carolina, Coed-Byclair Farm, *Howel-Jones, N.H.P.* 8322 ; Lydenberg, *Pentz, N.H.P.* 8515 ; Potchefstroom, *Liebenberg, N.H.P.* 8630 ; Vereeniging, Farm Zuurfontein, *Pentz, N.H.P.* 8497.

ORANGE FFEE STATE.—Parys, *Ramsbottom, N.H.P.* 8377 ; Heilbron, Maccauvlei, *Brandmuller* 54.

CAPE PROVINCE.—Mafeking, Pitsani, *Pole Evans and Pentz, N.H.P.* 8548. Bechuanaland : Padden on Molopo River, *Pole Evans* and *Pentz, N.H.P.* 8558.

Var. **glauca.**

Culms and stolons more slender, leaves shorter, glaucous, internodes of runners glabrous.

TRANSVAAL.—Pretoria : Hamanskraal, *Pentz, N.H.P.* 8499 ; Pretoria : Groenkloof Valley, *Mogg, N.H.P.* 7969 ; Klapperkop, *Stent* and *Mogg, N.H.P.* 7968.

A very useful grazing grass of the " Woolly Finger " type (*D.Pentzii*) but much taller and coarser with broader leaves, stouter runners.

D. Polevansii.

Stoloniferous perennial from a thickened much branched rhizome bearing numerous bulbous extravaginal innovation shoots covered with short silky tomentose cataphyls. The long, stout surface runners or stolons root firmly at the nodes and send up fascicles of bulbous based shoots, internodes purplish grey and up to 20 cm. or longer. *Culms* erect rather bare from a bulboid base, up to about 1·3 m. high, smooth, glabrous, 4–5 noded, branched from the lower or middle nodes, internodes mostly included except the uppermost which is long exserted ; *leaf sheaths* long, rather loose, finely ribbed, smooth, glabrous or the lower sometimes finely hirsute or ciliate and early falling away leaving a rather bare culm base ; *ligule* membranous, mostly truncate or rounded, denticulate, up to 3 mm. long and usually more or less appressed to the blade ; *blades* glaucous, linear lanceolate, slightly narrowed at the rounded base, tapering to a fine point, flat, up to 40 cm. long by 8–11 mm. broad, quite smooth, glabrous or minutely hirsute with a few tubercle based hairs at the base, margins cartilagenous smooth, primary lateral nerves about 5 not very conspicuous on either side the slender prominent midrib. *Racemes* up to 12 and about 9–16 cm. long strictly digitate or with an additional 1–4 terminating the shortly elongated angled axis, *rhachis* triangular with narrow winged, smooth or sparsely scabrid margins, ·5–·75 mm. wide, glabrous ; *pedicels* 2-nate, scabrid with cupular sub-membranous tips, the longer up to 2 mm. *Spikelets* appressed, sub-imbricating about 3 mm. long excluding the hairs at tip, narrow-oval-acute, greyish green to leaden or brownish when mature ; *lower glume* very small but distinct, thinly membranous, obtuse to sub-acute ; *upper glume* narrow, 3-nerved, acute, equalling about three-quarters to rather less of the fertile floret, with long silky hairs between the nerves and on the margins and tip ; *lower valve* usually purplish, ovate acute, the size of the spikelet, 7-nerved, midnerve prominent, lateral faint, smooth, lines of the silky obtuse usually appressed hairs between the inner lateral nerves and on the margins ; *fertile floret* eliptic, rather shorter than the lower valve, pale greyish green to light golden brown, flaps broad meeting or in some cases overlapping.

CAPE PROVINCE.—Bechuanaland, Vryburg, N.W. of Armadillo Creek, *Burtt-Davy* 13871; Kuruman, *Pole Evans* 2065, 3322, Molopo River, *Pole Evans* and *Pentz*, *N.H.P.* 8561; Mafeking between Vuilnek and Inkruip, *Pole Evans* 2418, 2419.

A very distinctive species with bulbous-like bases to the culms. The stout runners reach a length of 450–600 cm.

D. decumbens.

Perennial. Culms fascicled on a short rhizome, innovation shoots intravaginal, stoloniferous. Flowering culms up to 113 cm. rather bare at the base, many noded, usually decumbent, much and often repeatedly branched and often rooting at the lower nodes, glabrous, smooth, terete or slightly compressed; *sheaths* rather long and loose, smooth, glabrescent, those of the young shoots often finely hirsute especially at the nodes; *ligule* thinly membranous, truncate, about 3 mm. long; *blades* linear lanceolate from a slightly narrowed base tapering to an acutely acuminate tip, flaccid, minutely scaberulous, glabrous, up to 14 cm. long (those of barren shoots sometimes to 28 cm.) by 7 mm. broad, light green. *Racemes* up to 13 cm. long, typically widely spreading the lower almost horizontal, 6–10 arranged in a single whorl (usually of 6) at the apex of the culm or with the common axis elongated about 1–1·5 cm. and bearing a second whorl of 2–4 at the tip, occasionally with one or two scattered below the top whorl. *Rhachis* sub-flexuous, slender, flat on the back trigonous on the face with narrow but distinct green winged margins, scabrid, glabrous, from ·4–·8 mm. wide; *pedicels* 2-nate, slender trigonous, scabrid, longer up to 1·5 mm. long; *spikelets* rather loosely imbricating, narrow lanceolate-acuminate, 2·7–3 mm. long by ·6–·8 mm. wide, scantily and usually appressedly hairy; *lower glume* a minute obtuse membranous persistent scale, *upper glume* narrow oblong equalling half to three-quarters length of the spikelet, 3-nerved, nerves smooth lines of fine closely appressed silky hairs between the nerves and slightly longer (up ·5 mm.) and spreading hairs on the margins; *lower valve* the size of the spikelet, 7-nerved, rather close and prominent and smooth, apparently glabrous, but actually with narrow lines of closely appressed silky hairs in the lower half between inner pairs of lateral nerves and on the margins right to the tip of valve, hairs never longer than ·5 mm. and not or seldom spreading, *fertile floret* narrow lanceolate acuminate, slightly shorter than the lower valve, greyish yellow to purplish.

TRANSVAAL.—Barberton District: Nelspruit, *Pentz, N.H.P.* 8495.

The loosely fascicled culms the weak mostly desumbent and leafy stems, the widely spreading racemes and the apparently glabrous or sparsely and shortly hairy spikelets, distinguish it from *D. Pentzii.*

D. Swazilandensis.

Perennial more or less prostrate creeping grass sending out long slender rooting runners with numerous short glabrous or sparsely hairy internodes. Culms prostrate erect, very slender, glabrous smooth, terete, with many short, more or less included, internodes below the comparatively long (up to 13 cm.) uppermost internode; frequently branched and sending out leafy barren shoots. *Sheaths* somewhat compressed at length slipping from culm, glabrous except at the long hairy nodes or sparsely long and softly hairy, produced in an auricle on one or both sides of the mouth. *Ligule* rounded or truncate, thinly membranous about ·7 mm. long; *blades* flat narrow ovate-lanceolate from a rounded and contracted base, tapering to a narrow acute apex, up to 7 cm. long by 4 mm. wide, glabrous or with a few scattered fine hairs towards the base, smooth except at the tip and on the minutely scaberulous margins. *Racemes* 2–3 very rarely 4, slender, about 5–7 cm. long, *rhachis,* about ·4 mm. wide, narrowly winged, triquetrous and sharply angled on the face, glabrous and smooth except on the minutely scaberulous margins; *pedicels* 2-nate, terete or somewhat flattened or sub-triquetrous, longest about 1·5 mm. long, minutely scabrid on the margins; *spikelets* somewhat imbricating, 2–2·5 mm. long, about ·7 mm. wide, oval-acute, apparently glabrous. *Lower*

glume an obtuse to truncate, persistent, membranous scale ; *upper* oval acute, rather broad and thin, equalling half to two-thirds the length of spikelet, 3-nerved with scanty lines of appressed straight fine hairs between the nerves and on the margin those towards the tip longer and slightly denser ; *lower valve* thinly membranous the size of the spikelet, rather prominently, 7-nerved with scanty lines of appressed hairs between the inner pair of lateral nerves and on the margins, fertile floret oval, acute, purple.

Near to *D. horizontalis* but a perennial with shorter narrower and less scabrid leaves, and fewer racemes.

SWAZILAND.—Stegi *Mrs. Perkins N.H.P.* 7931 ; on the border near Mrs. Andrews' farm, *Pentz N.H.P.* 8557.

A prostrate grass that makes a mass of short dense matted foliage suitable for a lawn, or for short crop for sheep, does well with clover.

D. rigida.

Perennial, caespitose, sending out long branched and rather rigid runners that root and shoot from the nodes. *Culms* geniculate or prostrate erect about 75 cm. long, 4–6 noded, simple or branched, glabrous, smooth, sub-terete, compressable ; *sheaths of the leaves* firm, loose finely and closely striate, smooth, glabrous except at the densely silky nodes, or with a few scattered hairs ; *ligule* prominently exserted, membranous 5–14 mm. long, dentate, adnate to the often rather long auricles of the sheath ; *blades* linear, flat or folded, 5–20 cm. long by about 3–4 mm. wide, from an equally wide base long tapering to an acute apex, very firm, smooth glabrous or softly and sparsely hairy on the upper side, midrib rather stout and prominent below, whitish above, primary lateral nerves about 6 on either side, close and firm. *Racemes* 6–9 in whorls or sub-whorls on a short common axis, about 7–9 cm. long ; *rhachis* narrow, about ·5 mm. wide margined or very narrowly winged, scabrid, glabrous ; *pedicels* 2-nate or sometimes 3-nate towards the base, longest about 2 mm., scabrid ; *spikelets* imbricating, about 3 mm. long, ovate lanceolate, acute, *lower glume* a nerveless membranous scale ; *upper glume* equalling from half to two-thirds of the spikelet, 3 nerved with very dense lines of fine, straight, blunt hairs between the nerves and on the margins ; *lower valve* equalling the spikelet, 7-nerved, the inner pairs of lateral nerves rather remote from the central nerve and equally prominent, all smooth and with lines of rather fine, stiff, straight, blunt hairs between the inner lateral nerves and on the margins, the hairs between the nerves rather scantily appressed, those on the margins longer and rather denser. *Fertile floret* elliptic, lanceolate, shortly and acutely acuminate, firmly membranous, finely punctate striate, light green or purplish, margin rather distant ; *anthers* about 1·5 mm. purple.

TRANSVAAL.—Magalakwin, *Pole Evans, N.H.P.* 8530.

The very hard leaves and the long prominent ligule distinguish this species from other stoloniferous species of the same type. Roots of the grass were collected by Dr. Pole Evans in the Northern Transvaal and planted at Prinshof. This description is from a single flowering specimen collected from those roots.

D. glauca.

Perennial, densely tufted, with intravaginal innovation shoots on a short oblique or descending rhizome. Culms glabrous, terete, erect or sub-geniculate, rather stout, up to 135 cm. high, much or scantily branched from the lower nodes, 2–5 noded, lower internodes included, upper exserted, uppermost longer than half the culm ; *lower sheaths* compressed, from 5–12 cm. long, loose, finely ribbed, more or less densely hairy at the base, otherwise glabrous or with scattered rather long tubercle based hairs but never densely hairy ; *ligule* delicately membranous, oblong obtuse, 3–5 mm. long, 3-lobed or toothed, sides adnate with the sheath auricles, glabrous ; *blades* rather firm mostly strongly folded, finely ribbed, about 3 mm. wide to 30 cm. long, culm leaves shorter, finely scaberulous on the nerves on

either surface, glabrous, glaucous. *Racemes* about 4–7, sessile, obliquely ascending, about 10–14 cm. long, the lowest usually 2-nate or 3-nate, the succeeding variously arranged on a short angular scaberulous glabrous axis 3–5 cm. long, the terminal raceme solitary and erect, rhachis of racemes, triquetrous, very narrowly winged, ·3–·5 mm. wide, scabrid, finely pubescent at the junction with the main axis otherwise glabrous ; *pedicels* angled, slender, scabrid, with shallowly concave membranous tips, 2-nate or often on short contracted branchlets at the base of raceme ; *spikelets* loosely appressed or spreading, not imbricating, often their own length apart, narrow lanceolate-acuminate, 4–4·3 mm. long by 1 mm. wide, conspicuously but not very long, hairy ; *lower glume* an ovate, nerveless, rather firmly membrous scale usually about ·5 mm. long ; *upper glume* equalling about half to three-quarters the length of the spikelet, narrow ovate-obtuse, 3-nerved with lines of soft fine obtuse hairs between the nerves and on the margins, produced beyond the tip of the glume ; *lower valve* the size of the spikelet, 7-nerved, nerves smooth, rather close and equidistant, with lines of straight soft appressed or somewhat spreading hairs between the inner lateral nerves and on the margins, hairs up to 1.5 mm. long ; pale and lodicules, hyaline, minute ; *fertile floret* narrow oval acuminate equalling or slightly shorter than the lower valve, pallid sometimes faintly flushed with purple, the flaps of valve closely approximating.

Transvaal.—Pretoria : near Government House, *Pentz, N.H.P.* 8519, Pretoria, *Pentz, N.H.P.* 8670, Heidelberg, Henley-on-Klip, *Stent, N.H.P.* H. 21592.

Orange Free State.—Kroonstad, *Hall, N.H.P.* 8669 ; Fauresmith, Botanical Reserve, *C. A. Smith* 4098, 3960 ; *Breda* 16.

Cape Province.—Gordonia, Inkruip, *Pole Evans* and *Pentz, N.H.P.* 8555.

A tufted species very glaucous with foliage seldom above 30 cm. high and numerous tall erect flowering stems, very near to *eriantha* but differing from that species in its longer more rigid leaves, taller stouter culms, longer laxer racemes, more densely and long hairy spikelets, etc.

Var. **Bechuanica.**

Sheaths longer, densely hirsute, culms stouter, racemes more numerous and spikelets imbricating and more crowded.

Cape Province.—Mafeking : Langeberg Camp, *Pole Evans* 2421 ; Olifantshoek, *Pole Evans* and *Pentz, N.H.P.* 8556 ; Upington, on quartzite kopje, *Pole Evans* 2194.

D. natalensis.

Densely tufted perennial. *Culms* rather stout, up to about 120 cm. high, erect and very straight or more or less geniculate, simple or branched, glabrous, smooth or often scaberulous just below the panicle, 4–6 noded, lower internodes usually included, upper exserted, uppermost very long. *Sheaths* of the lower leaves firm sub-compressed, loose, up to about 25 cm., glabrous except at the usually hirsute base or more or less densely beset with rather rigid sharp pointed hairs especially on the margins, those of cauline leaves usually quite glabrous or more or less finely pubescent at base ; *ligule* rather firmly scarious, up to 15 mm. long, rounded or truncate, sometimes scantily but rather long ciliate, often with the margins produced and adnate to the auricles of the sheath mouth ; *blades* linear, up to 60 cm. long by 8 mm. wide (fresh material) flat or folded, tapering to an acute apex, smooth, or the upper surface minutely scaberulous, midrib rather broad and stout, lateral nerves prominent and close, blades of the upper culm leaves sometimes much reduced. *Racemes* many, digitate or sub-digitate on a short (up to 5 cm. long) common axis, 12–23 cm. long ; rhachis about ·5–·8 mm. wide, triquetrous, narrowly winged, straight or flexuous; scabrid on the margins and the facial angle, glabrous except at the minutely pubescent base ; *pedicels* 2-nate or 3-nate or sometimes in fascicles of 4–5, scabrid with truncate tips ; *spikelets* not or laxly sub-imbricating ovate lanceolate acute, about 3 mm. long ; *lower glume* minute but distinct, membranous ; *upper glume* narrow, obtuse, 3-nerved,

equalling about half the spikelet, lines of fine silky obtuse hairs between the nerves and on the margins; *lower valve* the size of the spikelet, 7-nerved, minutely scaberulous on the nerves and often on the spaces between, hairs between the inner lateral nerves and on the margin not very long, straight, acute, usually closely appressed or somewhat spreading with age and often mixed with rather rigid acute bristle-like hairs; *fertile valve* greenish grey, as long as or slightly shorter than the lower valve, rather firmly membranous, shortly apiculate, margins rather distant.

NATAL.—Umkomaas, *van Rensburg, N.H.P.* 8630 (type); Maritzburg, *McClean* 184; Zululand-Mtunzini *Mogg, N.H.P.* H.20026, H.20042; Ixopo, Glen Daun, *Bruce, N.H.P.* 8072; Matubatuba, *Harrison, N.H.P.* 8323; without precise locality *Storey* 21; Kentani, in valleys *Pegler* 1092.

Near to *D. Smutsii* Stent but very different in the field with more rigid leaves and longer ligule; the hairs of the spikelet are rather stiff and the nerves of the lower valve minutely scaberulous.

D. littoralis.

Densely tufted perennial on short stout descending rhizome. *Culms* erect or geniculate, rather stout, glabrous, smooth, 3–4-noded usually branched and often sending out fascicles of shoots from the lower nodes, up to 120 cm. high, lower internodes included, upper exserted; leaves very green, crowded and more or less flabellate at the base; *sheaths* loose, rather long, the lower shortly and appressed hairy at the base otherwise glabrous or with few scattered hairs, compressed, finely and closely striate; *ligule* up to 9 mm. but usually much shorter, minutely fimbriate; *blades* flat, linear. from a scarcely narrowed base tapering to long acuminate points, glabrous tip scaberulous, about 30 cm. long by 7 mm. broad, midrib prominent below, primary lateral nerves about 4 on either side, not conspicuous. *Racemes* 7–10, obliquely spreading, 10–16 cm. long, more or less whorled or scattered on a short common axis 2–3 cm. (very rarely more) long, rather dense or sometimes interupted, *rhachis* of racemes narrow, triquetrous, margined, ·5 mm. wide, scabrid, glabrous; *pedicels* 2-nate, longer about 1·3 mm., scabrid, angled, with membranous discoid tips. *Spikelets* sub-imbricating, somewhat crowded, lanceolate, oblong, 3·5–4 mm. long and 1 or slightly over 1 mm. broad, conspicuously hairy, hairs fine obtuse, under 1 mm. long; *lower glume* a well developed firmly membranous nerveless ovate-lanceolate obtuse to sub-acute scale, 1–1·5 mm. long; *upper* equalling about three-quarters the length of the spikelet, 3-nerved with hairs on margins and between the nerves; *lower valve* the size of the spikelet, 7-nerved, nerves often minutely scaberulous, equidistant or the inner lateral pair somewhat remote from the central nerve, hairs between nerves and on the margins appressed, ultimately spreading; *fertile floret* as long as the lower valve, anthers 2·3 mm. long.

CAPE PROVINCE.—Albany Division: Grahamstown, Schonland 3739 (type), Howiesons Poort, *Worracher, N.H.P.* 8671, *Dyer, N.H.P.* 8502; Port Elizabeth, *Gunn, N.H.P.* 7866, *Galpin* 6384; Port St. Johns, Eagle's Nest, *Howlett* 36.

Near to *D. natalensis* which is however a coarser grass with very firm leaves, more numerous racemes and coarser almost bristle-like hairs on the spikelet.

A densely tufted very green species, flowering culms, 126 cm. high and foliage about 50 cm. high. More resistant to frost than other species under cultivation.

Var. prostrata.

Densely tufted giving off numerous runners that root (rather lightly ?) at the nodes and always terminate in a flowering culm—they are in fact prostrate culms—fascicles of flowering shoots are given forth from most of the nodes. A very blue variety.

Cape Province.—Albany: Grahamstown, *Pentz*, *N.H.P.* 8021 and 8504; Port Elizabeth, *Gunn*, *N.H.P.* 8517, 7973, 8494.

Gunn 8494 is a rather smaller form with more slender flowering culms and very long runners which do not always terminate in flowering culms.

D. geniculata.

Perennial on a stout descending rhizome. *Culms* fascicled, prostrate erect up to 90 cm. high, much branched from the base and from the lower nodes, nodes usually many, the basal internodes short and included; *leaf sheaths* glabrous or hairy at the base and along the margins, smooth, rather loose, finely ribbed; *ligule* delicately membranous, glabrous, up to 7 mm. long but often appearing shorter from the tearing away or folding over of the delicate obtuse tip; *blades* linear from a slightly narrowed base tapering to an acuminate setaceous tip about 30 cm. long by 4 mm. wide, quite glabrous or sparsely hairy with scattered, long white hairs, scaberulous on the upper surface and margins, midrib, slender, somewhat prominent below, indistinct above, finely ribbed, primary lateral nerves scarcely distinguishable; *racemes* 4–9 digitate or sub-digatate on a short axis, about 9–12 cm. long, obliquely erect or rather widely (but not horizontally) spreading; *rhachis* narrow triquetrous, margined, scaberulous, pedicels triquetrous, 2-nate, scaberulous; *spikelets* narrow, ovate, lanceolate, acute or sub-acute 3·4 mm. long, rather lax, not imbricating; *lower glume* up to ·5 mm. long, membranous, nerveless; *upper* 3-nerved equalling half to three-quarters the length of the spikelet with rather dense lines of soft spreading hairs between the nerves and on the margins; *lower valve* the size of the spikelet 7-nerved nerves, smooth, equidistant, with lines of soft hairs between the inner lateral nerves and on the margins, hairs about ·5 mm. long, margins hyaline; *fertile floret* equalling or slightly shorter than the lower valve, lanceolate, yellowish to brown; anthers yellow, about 2 mm. long.

Cape Province.—Wodehouse: Dordrecht *Pentz*, *N.H.P.* 8049 (type), 8498; Oudtshoorn, De Rust *Pentz*, *N.H.P.* 8518; Willowmore, near Pienaars River, *Pole Evans* and *Pentz* *N.H.P.* 8508.

Orange Free State.—Senekal, Cyferfontein, *Joubert*, *N.H.P.* 7952.

D. foliosa.

Perennial on a shortly creeping rootstock with extravaginal innovation shoots covered with lanceolate-ovate membranous, closely ribbed hairy cataphyls. *Culms* slender up to 45 cm. high, shortly exceeding the leaves, 5-6 noded, branched from most of the nodes or only from the upper, internodes (except the uppermost) short included, leafy throughout but more so towards the top. *Sheaths* of the leaves thin, loose, the lower soon withering, glabrous except for occasionally a few tubercle based hairs towards the mouth; *ligule* thinly scarious, irregularly toothed, about 1·5 mm. 3-lobed the central lobe broadly rounded, the side lobes short or narrowly elongated and adnate to the sheath-auricles; *blades* rather dark green, linear lanceolate, flat, acutely long acuminate, 6–13 cm. long by 3–5 mm. wide, rather firm, with narrow cartilaginous margin, smooth, glabrous or with a few scattered tubercle based hairs mostly towards the base, midrib slender, prominent below, grooved above. *Racemes* slender, 2–7, digitate or sub-digitate, on a very shortly elongated axis, 4–6 cm. long; *rhachis* slender, flat on the back, trigonous on the face, narrowly winged, about ·5 mm. wide; *pedicels* scaberulous, 2-nate, angled or the shorter terete, sometimes on short appressed branchlets. *Spikelets* lanceolate acute, about 2–5 mm. long; *lower glume* a small membranous scale; *upper glume* ovate acute or sub-acute, equalling about three-quarters the length of the spikelet and about as broad at the base, 3-nerved, the hairs between the nerves and on the margins very fine blunt and under 1 mm. long; *lower valve* the size of the spikelet, thin, 7-nerved, three middle nerves, slender but rather prominent, others somewhat obscure, hairs between the inner lateral pairs short and appressed, the marginal longer but also usually appressed; *fertile floret* narrow ovate acute, slightly shorter than the lower valve, margins approximating; anthers and stigmas purple.

CAPE PROVINCE.—Kuruman, Vuilnek, *Pentz, N.H.P.* 8527.

A distinct species presenting, when growing, a bushy effect with the flat rather firm leaves gathered towards the tops of the culms leaving the bases covered only with the withering sheaths. The comparatively short flowering culms and racemes are also rather distinct.

D. trichopodia.

Upright perennial, innovations intravaginal (?). *Culms* about 45 cm. high, 2–3 noded, simple, rather stout, densely and rather softly hairy in the upper part below the panicle. *Sheaths* of the cauline leaves rather tight exceeding to very little shorter than the internodes, glabrous except at the rather long and densely bearded nodes, smooth; *basal sheaths* brownish rather firm, loose, like the ovate acute cataphylls densely silky hairy at the base and more or less so further up; *ligule* rounded or truncate, membranous, glabrous, rather short or up to 3 mm. long, rather firm; *blades* broad, flat, up to about 19 cm. long by 10 mm. wide, smooth, or scaberulous in the upper surface, glabrous except for a few scattered long hairs on either side the ligule, midrib slender not prominent, primary lateral nerves 5–6 on either side. *Racemes* compound towards the base 5-10, solitary on an elongated common axis forming a more or less contracted panicle, axis up to 12 cm. long, angled and ribbed and covered with long cream, silky rather thick walled acutely acuminate hairs, branches short and appressed; *rhachis* trigonous, flexuous, margined, about ·5 mm. wide, densely hirsute along the margins and on the face with the same long shining rather rigid hairs; *pedicels* 2-nate or solitary or more often in fascicles of 3–6, densely long, hairy, the hairs at the discoid tips exceeding to spikelets. *Spikelets* crowded almost hidden by the copious hairs of the rhachis and pedicels, quite glabrous and smooth; light golden brown paling to yellow at the tips, ovate acute, rather plump about 2 mm. long; *lower glume* 0, upper reduced to a thinly membranous emarginate nerveless or faintly 1–3 nerved scale about ·5 mm. long; *lower valve* the size of the spikelet, thinly membranous 3-5-nerved, the outer nerves when present some distance from the margins, very faint and evanescing above, the two inner lateral nerves anastomosing with the centre nerve just below the tip, *pale and lodicules* wanting; *fertile valve* golden brown rather tough the hyaline flaps sometimes overlapping at the tip or distant to the base; *pale* resembling the valve but more deeply coloured on the back and with the flaps narrow towards the tip and overlapping at the base; *anthers* about 1·5 mm. long, brownish.

CAPE PROVINCE.—Komgha Division, grassy slopes near Kei Mouth, *Flanagan* 987.

The only specimen I have seen of this grass which was collected by Flanagan in 1892, there are no barren shoots and the tips of all the leaves are broken off.

Very near to *D. uniglumis* but with broader leaves, longer and more copious setae on the axis and pedicels and larger spikelets and more compound racemes, etc. Also very near to *D. Grantii* Hubbard from which it differs in the densely bearded sheath-nodes, wider leaves, longer and more densely silky racemes, etc.

D. apiculata.

Perennial, rather loosely fascicled with intravaginal and extravaginal innovation shoots the latter covered at the base by linear lanceolate, strongly striate cataphylls. *Culms* geniculate, slender, simple, 2–3 noded with lowest internode very short, smooth, glabrous or softly pubescent for a short distance below the panicle; *leaf sheaths* narrow, rather loose, striate finely hirsute, those of the slender barren shoots about 3–5 cm. long; *ligule* not exserted, firmly membranous and brownish, up to 1 mm. long, sheath margins not produced; *blades* narrow linear from 1·3 mm. to 3 mm. wide and up to 17 cm. long, not or slightly narrowed at the base, long tapering to a fine point, rather rigid hairy on both surfaces, margins revolute, midrib slender but prominent with 3–5 primary lateral nerves scarcely differentiated from the secondary, all rather prominent and the leaf therefore having a ribbed

effect. *Racemes* 4–7 and up to 8 cm. long solitary common axis very short, slender, angular, ribbed, minutely pubescent and scabrid, rhachis about ·5 mm. wide, triquetrous with narrow scabrid margins and occasional fine hairs below the pedicels; internodes 2·5–5 mm. long; *pedicels* binate or ternate or in fascicles of 3–5, very uneven in length the longest commonly up to 3 or 4 mm. long, slender, scabrid with small discoid tips. *Spikelets*, rather loosely spreading, about 2 mm. long, ovate acute, rather plump and quite glabrous; *lower glume* minute broadly clasping, thinly membranous to hyaline, truncate nerveless; *upper glume* ovate obtuse equalling less than half the spikelet, thinly membranous prominently 3-nerved; *lower valve* equalling or almost, the spikelet in length, very thin rather narrow ovate acute, prominently 5-nerved, nerves smooth, equidistant; pale and lodicules minute; *fertile valve* determining the size of the spikelet, elliptic oblong, minutely apiculate, coriaceous, light yellowish brown when young soon deepening to dark brown except at the base and the small apiculus which remain yellow; *pale* of the same texture and colour as the valve; lodicules broadly cuneate about ·5 mm. long; *anthers* little over 1 mm. ovary narrow ovate, stigmas long plumose at the tips of the styles, grain not seen.

SWAZILAND.—*Burtt-Davy* 2820 (type); Transvaal: Barberton, Devils Kantoor, Kaapsche Hoop, *Pole Evans* 1013.

Nearest to *D. Ibura* but a perennial with slenderer, fewer and not compound racemes narrower leaf blades, etc. The small yellow apiculus of the dark valve was very noticeable.

CONTENTS.

AN ACCOUNT

OF THE

SOUTH AFRICAN SPECIES OF *TRIBULUS* *Tourn. ex Linn.*

BY

H. G. SCHWEICKERDT, B.Sc., Ph.D., F.L.S.

In Southern Africa, the genus *Tribulus* L. is of considerable economic importance, since several species have been found to be the cause of a troublesome disease in sheep, known as "geeldikkop."

Preliminary experiments and investigations carried out during the past few years by veterinary and agricultural officers in connection with this disease, have resulted in the accumulation of much material in certain South African herbaria. Increasing difficulties were encountered in naming such material forwarded for identification from various sources to the National Herbarium, Pretoria. These difficulties were due to the fact that the species appeared to be ill-defined and the writer was consequently encouraged to undertake a study with a view of defining more clearly the limits of these species.

During the course of this investigation the material in the South African and that from Southern Africa in several of the larger European herbaria was studied. [Royal Botanic Gardens, Kew; Brit. Museum (Natural History); Berlin-Dahlem; German Univ., Prague; Mus., Stockholm; Univ., Zürich.]

The conclusions arrived at in this paper have thus been based almost entirely on the study of dried material. As will be pointed out, the results have proved to be somewhat inadequate and unsatisfactory, i.e. the limits of several species as yet remain uncertain.

Recourse to field work and breeding experiments seems desirable, in order that a clear concept of the limits of such species be obtained which appear to exhibit an extremely wide range of variation in vegetative, flowering and fruiting characters.

The first record of the genus *Tribulus* in a work relating to South African plants appears to be that of *Thunb. Prodr.* 79 (1794) where the Mediterranean species *T. terrestris* L. is enumerated. *Harvey* in his *Genera of S. Afr. Pl.* 46 (1838) likewise only mentions this species, and remarks that it is "a very common weed in cult. ground in the months of Nov. and Dec. It is perhaps merely naturalised from the South of Europe." *Presl, Bot. Bemerk.* 29–30 (1844) enumerated five species from the (present-day) limits of the Cape Province. He considered these five species to be distinct from *T. terrestris* L. In how far his views are justified will be dealt with under the species concerned. *Harvey* apparently overlooked *Presl's* paper, as only two species are enumerated in the second edition of his *Genera of S. Afr. Pl.* 36 (1868), although the first volume of the *Fl. Cap.* (1859–60) had by then been published. In the latter *Sonder* mentions four species, accepting and rejecting some of *Presl's* species. During the time between the appearance of *Fl. Cap. I.* and the present day, relatively few references to South African *Tribuli* are to be found in literature. Apart from *Engler's* account in *Veg. der Erde*, no comprehensive

enumeration of the species exists. In *Fedde Rep.* XXIV (1927) *Dinter* enumerates the species which had been recorded from South West Africa up to the year 1917 and *Range* did very much the same thing, on the basis of his own collections, in *Fedde Rep.* XXXVI (1934).

The following pages are thus intended to be of a revisional character as well as a critical exposition of the conclusions drawn from the study of a wide range of herbarium material from southern Africa.

In the list of localities given under each species only such specimens as were actually seen and examined are quoted.

TRIBULUS Tourn. ex. Linn. Syst. ed. I (1735); Linn. Sp. Pl. ed. I. 386 (1753):-

Sepals 5, deciduous or semi-persistent. *Petals* 5, spreading, shorter to longer than the sepals, deciduous. *Stamens* 10, those opposite the petals somewhat longer than those alternating with the petals; filaments subulate, those opposite the sepals with both an extra and intrastaminal basal gland; anthers cordate or oblong-cordate; intrastaminal glands free or connate to form a shallow cup at the base of the ovary. *Ovary* sessile, covered with erect bristle-like hairs, 5-lobed, consisting of 5 intergrown carpels: each carpel with 3-5 ovules; style short or absent; stigma conspicuous, 5-angled, pyramidal or hemispheric, formed by intergrowth of the 5 stigmatic lobes. *Fruit* 5-angled, at length breaking up into 5 indehiscent cocci; cocci dorsally tuberculated, unarmed, spinous, winged, or winged and spinous, 1-5 seeded. *Seeds* exalbuminous.

Xerophilous, mostly annual or perennial herbs, more rarely perennial shrubs; branches prostrate or ascending, more rarely erect. *Leaves* opposite, one usually larger than the other, more rarely alternate, bistipulate, abruptly pinnate; leaflets opposite, entire, somewhat oblique. *Pedicels* axillary, one-flowered. *Petals* usually yellow.

TAXONOMICALLY IMPORTANT CHARACTERS.

The habit of the plant is of some importance. The erect shrubby perennial nature of *T. excrucians* Wawra is a constant and unique character among the African species known up to the present day and by means of which it may readily be distinguished from the other species. The remaining members are all very much alike in habit, i.e. usually prostrate or semi-prostrate annuals or perennials.

In purely vegetative characters each of these species shows a marked degree of variation, being very plastic with regard to the size, shape, indumentum, etc., of the vegetative parts. Such variation is frequently met with in plants inhabiting arid or semi-arid regions and may probably be accounted for by the edaphic and climatic conditions under which the plants develop.

The length of the pedicel appears to be of some taxonomic value. In the *large-flowered prostrate* species it always exceeds the subtending leaf, and even in extreme cases still attains the length of the leaf, whereas in the small-flowered species the pedicel is usually exceeded by the leaf.

The size of the flower and hence the petals is of some value, since species such as *T. terrestris* L. may be excluded from the " large-flowered " species on basis of this character. The ratio of length of petals to sepals is of very little and in the writer's opinion probably of no taxonomic value. Many measurements carried out with a view to detecting whether that ratio is a character of some constancy proved it to be of little value; the flowers on even one and the same individual show such strong variation that allied species (distinguishable by other characters) were found to overlap.

The nature of the intrastaminal glands situated at the base of the ovary has been found to be of great taxonomic value, and two forms may be recognised: (*a*) glands free,

distinct, and not connate (fig. I.), (*b*) glands connate to form a shallow cup at the base of the ovary (fig. II.). At times the region of intergrowth of the glands is not readily visible in herbarium specimens, and in such cases soaking and careful dissection is essential.

The shape and size of the stigma appears to be correlated with the nature of the intrastaminal glands. A hemispheric somewhat asymmetric stigma (fig. I.) is found in species with free glands and small flowers, whereas a very much larger pyramidal almost symmetric stigma (fig. II.) is correlated with intergrown glands. The length of the style appears to be variable and for this reason was discarded as a taxonomically useless character.

Taxonomically the fruits are of the greatest importance. In their absence several closely allied species, resembling each other in vegetative and floral characters, are readily confused; in order to identify large-flowered species with certainty the presence of fruits is indispensable. Whereas the fruits of species such as *T. cristatus* Presl exhibit characters which have proved to be fairly constant and thus taxonomically of the utmost importance, other species exhibit but little constancy in this respect. *T. excrucians* Wawra may serve as an example of the species in which the fruits exhibit great variation both in regard to size and degree of spinosity of the individual cocci. Owing greatly to the limited amount of material available for study to the older authors, too much value was attached to the nature of the fruits. Study of a wide range of material has shown that fruit characters of several species are to be used with some discretion. This remark brings forward the question of natural hybrids about which *Dinter* states that he has never observed any plant possessing "Bastardeigenschaften." As will be shown later, there appears to be evidence in favour of the occurrence of natural hybrids among the species of *Tribulus* from Southern Africa.

KEY TO THE SPECIES.

I. Intrastaminal glands connate to form a shallow cup at the base of the ovary; stigma slender, usually pyramidal (fig. II.):—

A. Plant an erect shrubby perennial attaining a height of 1 metre or more; main stem woody with corky bark; fruits (cocci) unarmed or armed with one or two pairs of short lateral spines; spines at times somewhat flattened and almost winglike.................1. *excrucians*.

AA. Plant annual or perennial, *prostrate* or at length with the extremities of the branches somewhat ascending:

B. Cocci winged; wings armed with spines or wholly devoid of spines:

C. Wings of cocci with numerous pungent slender marginal spines and very often a long spine arising from the centre of each wing near the dorsal crest of the coccus......................2. *cristatus*.

CC. Wings of cocci without or with several marginal blunt teeth but never with a spine arising from the surface of the wing, leathery and subrigid, or thin papery and brittle in texture extremely variable in shape.....................................3. *pterophorus*.

BB. Cocci never winged but armed with 2 or more pairs of spines; spines variable in length, arising from the sides of the dorsal crest or near the base of the coccus.......................4. *Zeyheri*.

II. Intrastaminal glands free, never connate to form a shallow cup; stigma hemispheric, never slender (fig. I); petals 2-12 mm. long; sepals 2–6 mm. long..5. *terrestris*.

ENUMERATION OF THE SPECIES.

1. T. excrucians Wawra, in Sitzb. Akad. Wien. Math.—Nat. XXXVIII. 557 (1860).

Syn.: *T. micans* Welw. Apont. 566 (1858), nomen subnudum.

T. terrestris Oliv., in Fl. Trop. Afr. I, 283 (1868) *pro parte*, non Linn.; Hiern., Welw., Cat. Afr. Pl., 105 (1896).

T. Pechullii O. Kuntze in Jahrb. Bot. Gart. Berl. IV, 262 (1886); Engler, Jahrb. X, 31 (1888); Schinz in Bull. Herb. Boiss. II, 187 (1894); Heering and Grimme, Untersuch. Weideverh. Deutsch-Südwest afr., 27 (1911); Engler, Veget. der Erde. 9, III, i, 738 (1915), cum fig. 343 P–R et Pflzfam. ed. II, 19a, 176 (1931), cum fig. 84 P–R.

T. Zeyheri Sond. var. *Pechuelii* Schinz, in Verh. Bot. Ver. Prov. Brandenb. XXIX, 54 (1887).

T. inermis Engl., Bot. Jahrb. X, 32 (1888), non Kralik.; Heering and Grimme, Untersuch. Weideverh. Deutsch-Südwestafr., 27 (1911).

T. erectus Engl., Bot. Jahrb. X, 32 (1888); Dinter, Deutsch-Südwest-Afrika, 86 (1909); Engl., Veget. der Erde 9, III, i, 738 (1915); Dinter, in Fedde Rep. XXIV, 14 (1927).

An erect or suberect perennial *shrub* up to 1.5 m. high, with a short stem, up to 5 cm. thick near the base. *Branches* erect, robust, longitudinally striate, terete, pubescent, glabrous in age; internodes up to 6 cm. long, but usually much shorter. *Leaves* unequal; the larger up to 7 cm. long, 6–10-jugate; the smaller up to 3 cm. long, 3–6-jugate; stipules up to 7 mm. long, linear-lanceolate to obliquely lanceolate, acute, silky pubescent on the outer surface, less so on the inner surface; petiole silky pubescent, slightly winged towards the apex; leaflets obliquely oblong to lanceolate, acute, up to 25 mm. long and 8 mm. broad, but usually much smaller, densely silky pubescent on the lower surface. *Pedicel* fairly short, 1.5-2 cm. long, terete, silky pubescent, markedly striate in age. *Flower-buds* ovate, markedly acuminate. *Sepals* linear-lanceolate, up to 11 mm. long and 3 mm. broad, silky pubescent on the outer surface. *Petals* broadly cuneate, up to 25 mm. long, often much smaller. *Filaments* 3 5 mm. long; anthers 2.5 mm. long. *Intrastaminal glands* connate to form a very shallow cup at the base of the ovary. *Stigma* pyramidal, about 2.5 mm. long. *Mature fruit* at length breaking up into several (usually less than 5) cocci; cocci unarmed or armed, some without any signs of spines, merely tubercled laterally and dorsally, densely but very minutely pubescent, others again armed with 1-3 pairs of lateral spines, which at times are much flattened and almost wing-like (fig. III).

Angola.—Loanda: July, *Menyhart*, 228. Lobito Bay: Aug., *Obermeyer*, in Herb. Tvl. Mus. 32816. Benguela: Jan., *Wawra*, 299 (types in Herb. Mus. Nat. Hist. Vindob).

Between Mossamedes and Rio Bero: Apr., *Hopfner*, 5. Mossamedes: July, *Welwitsch*, 1579, 1580. Oct., *Brühl*, 5, 6. *Jessen*, 329. March, *Fritzsche*, 2.

South West Africa.—Swakopmund: *Dinter* 22. *Belck*, 63a; upright perennial in bed of river, *Bradfield*, 550. 580. Swakopriver: May, *Marloth*, 1457. Nov. *Rewsch*, 63a. Walfish Bay: Okahandja: Oct., *Luderitz*, 147. Husab: June, *Fleck*, 727. March, *Dinter*, 8446. Kuwosis: Oct., *Schenck*, 433. Haigamchab: Jan., *Galpin et Pearson*, 7607, 7637; shrub along banks of Swakopriver, June, *Gurich*, 129, 147. Khanthal: Apr., *Engler*, 6058. Ukuib: Dec., *Pogge*, 9. Gamkoischas: May, *Dinter*, 207. Usakos: June, *Marloth*, 1457a; Nov., *Schinz*, 1120. Otjimbingue: May, *Marloth*, 1300, 1390. Okahandja, cult.: Nov., *Dinter*, 207.

Without precise locality: *Luderitz*, 208. *Schenck*, 452. *Nels*, 16. *Francois*, 38. *Pechuel Lösche*, 36.

In the description of *T. excrucians*, Wawra l.c. cites the type as being his 290. The specimen in the Vienna Herbarium and a duplicate of same in the Zurich Herbarium both bear the number 299. The number *Wawra* 290 is thus probably a typographic error for 299.

The shrubby nature, together with the peculiar ashy-grey silky appearance of the plant, are the most reliable characters by which this can be distinguished from other related species. Apparently *T. excrucians* has been overlooked by all authors cited below since they do not refer to this species in their work relating to *Tribulus*.

O. Kuntze (1886) l.c. in describing *T. pechuelii* apparently did not know that he was dealing with a shrubby species (the label on the type specimen gives no information with regard to the habit of the plant). He consequently made use of the number of leaflets per leaf, the nature of the fruit and other characters to distinguish his species from allied plants such as *T. Zeyheri* and *T. cistoides*. Both the latter, however, are prostrate in habit, the branches only rarely ascending to a few centimetres above the level of the substratum, whereas *T. excrucians* (*T. Pechuelii* of various collectors) is a perennial undershrub or shrub attaining a height of up to 1.5 metres. It also possesses a short main stem which may equal a "man's wrist" in thickness.

The colour of the flowers may either be pale yellow (*Dinter*) or yellow with a dark claw (*Marloth*). The size of the petals is variable and may be anything from 15-24 mm. long; the petals are $\pm$ 2.5 times the length of the sepals.

Schinz (1887) l.c. pointed out that contrary to *Kuntze's* statement regarding the unarmed nature of the fruits, the cocci showed the presence of small spines. As a consequence of the armed nature of the cocci, *Schinz* lowered the rank of this plant and considered it to be a variety, viz. *T. Zeyheri* Sond. var. *Pechuelii* Schinz. Schinz at this time was unaware of the shrubby nature of the species.

Engler (1888) l.c. independently described a shrubby species (*T. erectus*) from South West Africa. He also hinted at the presence of a second erect species in the form of *T. inermis* since he described the habit of this plant as "procumbens ?". *Engler* had overlooked *T. excrucians* Wawra but had naturally consulted *Kuntze's* type in drawing up his descriptions; being a hypercritical worker he considered *T. erectus* and *T. inermis* to be distinct from *Kuntze's* species (the latter is a very fragmentary specimen only possessing young fruits). His views which were naturally based on the material available for study at the time appear to have been by no means unreasonable.

As a result of *Engler's* work as well as the study of further material *Schinz* (1894) l.c. subsequently somewhat modified his earlier views regarding the taxonomic position of *T. Zeyheri* Sond var. *Pechuelii* Schinz. He revived *T. Pechuelii* Kuntze, and considered it a valid species still closely allied to *T. Zeyheri* Sond. Engler's species *T. inermis* and *T. erectus* had also come to his notice and realising the great variability of the fruits he correctly considered them to be conspecific with *T. Pechuelii* Kuntze. Attention may be drawn to the fact that *T. micans* Welw. from Angola had apparently been overlooked and perhaps wilfully excluded in the absence of a description by all three authors mentioned above. [Since *Welwitsch* did not draw up a valid diagnosis *T. micans* Welw. is a *nomen subnudum*.] The type of this plant in Herb. Mus. Brit. undoubtedly is conspecific with *T. excrucians* Wawra, which is the oldest validly published name for this species. *Dinter* (1927) l.c. also considers *T. erectus*, *T. inermis* and *T. Pechuelii* to be conspecific, but adopts the name *T. erectus* to designate the species which, however, is not in accordance with the International Rules of Nomenclature.

As a result of my own studies of dried material I have arrived at the conclusion that all the species in question are conspecific. The fruits of many specimens seen showed either the presence or absence of spines; at times the spines were so weakly developed that they could easily have been overlooked. The fruits of even one and the same plant

show a fair degree of variation. *Dinter* (1927) l.c. says of *T. erectus* that this species " ist in jeder Beziehung konstant, wenn auch hôchst wahrscheinlich aus T. Zeyheri hervorgegangen," furthermore that the fruits may either be spineless or weakly thorny.

Marloth 1457 and 1457b from Swakop, S.W.A. and *Pocock* 975 from Benguella, Angola belong to *T. excrucians.* These sheets, however, have elliptic acute leaflets which are much larger (25 mm. l.) and broader (up to 9 mm.) and more markedly veined than those of the typical species. *Engler* (1888) l.c. places *Marloth* 1457 and 1457b under *T. Pechuelii* but mentions that *Marloth* collected " diese Art....... in zwei Formen." The cocci of *Marloth* 1457 and 1457b are glabrous in age except for a few bristly hairs, whereas in *Pocock* 975 they are densely minutely pubescent. In all these specimens the cocci are armed with 1–2 pairs of short lateral spines and the whole appearance of these fruits is somewhat different from those of typical *T. excrucians.* But having studied a wide range of material I am of opinion that all the sheets cited above probably only represent *one variable* species.

Study of this interesting species together with breeding experiments will undoubtedly be necessary in order to prove whether in the foregoing only a single or perhaps more than one closely related species is involved.

T. excrucians Wawra appears to have a very limited geographic distribution. It is only known to occur in the western regions of the Mandate of South West Africa and Angola, where it is mainly found growing in or near the dry sandy beds of desert rivers.

2. **T. cristatus** Presl, Bot. Bemerk., in Abh. Böhm. Ges. Wiss. V. 3.29 (1844); Sond., in Fl. Cap. I. 354 (1859–1860); Glover, in Ann. S. Afr. Mus. IX. iii. 170 (1913); Engl., Veg. der Erde 9. III. i. 738 (1915), cum fig. 343 V; Dinter, in Fedde Rep. XXIV. 15 (1927); Engl., Pflzfam. ed. II. 19a. 177 (1931), cum fig. 84 V; Range, in Fedde Rep. XXXVI. 249 (1934).

As *Presl's* description is somewhat incomplete and that of *Sonder* in the *Fl. Cap.* was based on the same gathering and consequently does not add much to it, it was thought necessary to draw up an amended description based on the material now represented in the South African and European herbaria consulted.

An annual, or possibly a biennial or perennial plant. *Branches* prostrate, radiating from the much branched rootstock, 12–100 cm. long, usually again branched but not conspicuously so. Branches, stipules, leaves, peduncles and calyx, in fact all vegetative parts of the plant usually hirsute with bulbous-based bristly hairs; internodes terete, striate, 0·5–6·0 cm. long. *Leaves* unequal, the larger 1·5–6·5 cm. long with 3–8 pairs of leaflets; the smaller (subtending a branch or flower) with 2–4 pairs of leaflets and much shorter than the first internode of the subtended branch, or the peduncle; stipules 2·5–8 mm. long, obliquely lanceolate, acuminate, upper and lower surface hirsute or almost glabrous, with marginal bulbous-based hairs; petiole hirsute or minutely pubescent, at times somewhat winged; leaflets hirsute or glabrous except along the midrib above, hirsute and paler beneath, obliquely oblong, obtuse or acute, with marginal bulbous-based hairs, up to 14 mm. long and 6 mm. broad but usually much smaller. *Pedicel* 2·5–4 cm. long, usually 2 to 3 times the length of the subtending leaf, striate, terete, set with tubercle-based hairs interspersed between a finer indumentum. *Flower-buds* abruptly acuminate. *Sepals* persistent, acuminate, 8–12 mm. long. *Petals* broadly cuneate, up to 25 mm. long, apparently always pale yellow in colour, twice or slightly more than twice as long as the sepals. *Filaments* up to 4 mm. long, bearing anthers about 2 mm. long. *Style* one-third to two-thirds as long as the stigma; stigma conical-oblong, slender and 2–3·5 mm. long. *Disc* at base of ovary a shallow cup formed by the intergrowth of the *intrastaminal glands*. *Mature fruits* variable in size, glabrous except for a few bristle-like hairs, 6–25 mm. long, 12–30 mm. in diameter including the wings, finally breaking up into 5 cocci; cocci with lateral oblong rounded wings, dorsally ridged and set with tuberculate bristly hairs; wings rounded, transversely markedly striate with marginal subrigid acute spines of unequal length often

bearing an analogous spine dorsally from the centre of each wing near the body of the coccus, a character which appears to be unique and by which this species may readily be distinguished from all the other South African species. This spine may sometimes be intergrown with the wing and in such cases is less conspicuous (Fig. IV).

South West Africa. Great Namaqualand: Elephantenfluss: *Range*, 1483; Eirup; nr. Marienthal: March, *Steyn*, 22533. Gouchassib R.: Aug., *Range* 727. Nabaos nr. Keetmanshoop: Apr., *Range*, 1313. Kuibis: Sandstein plateau: Jan., *Dinter*, 1166 and Tafelbergsandstein: Jan., *Dinter*, 1248. Seeheim, sandy bed of Fish river: Apr., *Engler*, 6633 and Apr., *Dinter*, 2967. Klein Karas: October, *Dinter*, 5055 and Apr., *Ortendahl*, 95. Satansplatz: March, *Dinter*, 2041. Wasserfall: Jan., *Pearson*, 3151. Between Dabaigabis and Gründoorn: Febr., *Pearson*, 3154.

Cape Province.– Little Namaqualand: Verleptpram, stony hills on the Orange river: *Drège*, 7160 (type deposited in Herb. Univ. Germ. Prag.). Herbert: Douglas, *Orpen in Mus. Austr. Afr.*, 14494. Prieska: Prieska, on sand dunes north of Orange river: March, *Wilman*, 3039 and 3040; in sand near Prieska, March, *Bryant*, 880 and J. 251.

Examination of many herbarium specimens has led me to believe that the above species is an annual. Specimens such as *Dinter* 5055 and *Pearson* 7863, however, suggest that the plants may be biennial and even perennial since these sheets possess a moderately branched rootstock bearing the remains of dry withered branches at the apex. *Bryant* 880 in Herb. Kew. bears a note to the effect that the species is annual.

T. cristatus Presl appears to be consistently prostrate in habit with the branches radiating from the crown of the rootstock. The length of the internodes of the branches is a very variable one; robust specimens usually have longer internodes than weaker specimens. This character appears to be correlated with the size of leaf, leaflets, flower and fruit, i.e. a weak specimen usually is smaller in all vegetative and reproductive characters than a luxuriant specimen. There does not appear to be a great deal of variation in the degree of hairiness in the vegetative parts of the species.

Bryant 880 bears a remark to the effect that this species does not "vary in flower or shape of fruit." From my own observations of herbarium material I cannot agree with the first part of this statement. The smallest flowers so far seen had sepals 8 mm. long and petals about 18 mm. long, the largest sepals up to 12 mm. long and petals up to 25 mm. long. The colour of the petals appears to be consistently pale yellow in colour and according to *Bryant* the "flowers open for an hour or two in the morning" and are "very fugacious." The shape and consistency of the fruits undoubtedly form the best diagnostic characters of the species. Whereas the size of the fruits is variable, the shape and texture, however, is fairly consistent. The largest fruits seen had wings about 25 mm. long and up to 10 mm. broad, but on an average the fruits are much smaller. The species flowers during the months of November and April.

The plants appear to prefer a sandy substratum and the species therefore is primarily psammophytic and according to *Bryant* is "very rarely found on hills."

The distribution is fairly restricted and the species appears to be limited to the sandy regions of Griqualand West, Little and Great Namaqualand. It has not yet been recorded further north than the Mandate of South West Africa and its southern limit appears to be approximately the Orange River basin.

Bryant has observed that this species "often grows alongside *T. terrestris* L. but never hybridises apparently." *Dinter* regards *T. cristatus* Presl as being a very good species having nothing in common with *T. pterophorus* Presl, an opinion which I am inclined to endorse.

If accompanied by young or preferably mature fruits, *T. cristatus* Presl may always be readily indentified. It is one of the most clearly defined species in the whole genus and owing to its characteristic fruits, taxonomically occupies a somewhat isolated position.

Among the material examined none was observed to exhibit intermediate characters, an indication that this species does not tend towards natural hybridisation.

3. **T. pterophorus** Presl, Bot. Bemerk, in Abh. Böhm. Ges. Wiss. V. 3. 29 (1844); Sonder, in Fl. Cap. I. 353 (1859–1860); Dinter, Deutsch-Südwest-Afrika, 86 (1909); Glover, in Ann. S. Afr. Mus. IX. iii. 170 (1913); Engl., Veg. der Erde, 9. III. i. 738 (1915), cum fig. 343 U; Burtt Davy, Flow. Pl. & Ferns I. 187 (1926); Dinter, in Fedde Rep. XXIV. 15 (1927) et Fedde Rep. Beih. LIII. 50 (1928); Engl., Pflzfam. ed II. 19a. 176 (1931), cum fig. 84 U; Range, in Fedde Rep. XXXVI. 249 (1934).

Syn.:—

T. alatus Drège, Zwei Pflzgeogr. Docum. 227 (1843), non Del.

T. securidocarpus Engl., Veg. der Erde, 9. III. i. 738 (1915) in obs., cum. fig. 343 S. a, b, c; Dinter, in Fedde Rep. XXIV. 15 (1927); Engl., Pflzfam. ed. II. 19a. 176 (1931), cum fig. 84 S. a, b, c; Range, in Fedde Rep. XXXVI. 249 (1934).

T. securidocarpus Engl. forma *vulgaris* Engl., l.c., cum fig. 343, S. a, b.

T. securidocarpus Engl. var. *subtruncatus* Engl., l.c., cum fig. 343. S. c.

T. albescens Schltr. ex Dinter, in Fedde Rep. XXIV, 14 (1927), nomen tantum; Engler, Pflzfam. ed. II. 19a, 176 (1931).

An *annual*. *Branches* prostrate, radiating from the much branched crown of the rootstock, up to 100 cm. long and usually somewhat branched again, in all vegetative parts more or less densely hirsute with a fine indumentum scattered between which are much longer bulbous-based hairs; internodes up to 10 cm. long, usually much shorter, striate, terete. *Leaves* unequal; the larger up to 6 cm. long, 6–9-jugate; the smaller (subtending a branch or pedicel) up to 3·5 cm. long, 3–6-jugate; stipules 3·5–6 mm. long, obliquely lanceolate, acute, upper and lower surface pubescent, with marginal tubercle-based hairs; petiole not winged; leaflets obilquely oblong, sub-acute or oblique, up to 12 mm. long and 6 mm. broad, densely silky beneath, less so on the upper surface. *Pedicel* 1–3 times as long as the subtending leaf, up to 3·5 c.m long. *Flower-buds* ovate in outline, hardly acuminate. *Sepals* linear-lanceolate, up to 10 mm. long and 2·5 mm. broad, acute, silky pubescent without. *Petals* broadly cuneate, 1·5 to 2 times the length of the sepals, up to 20 mm. long and apparently bright yellow to orange in colour. *Filaments* up to 4 mm. long, bearing anthers up to 3·0 mm. long. *Style* short; stigma broadly pyramidal, 1·25–2·5 mm. long. *Intrastaminal glands* united to form a shallow cup at the base of the ovary. *Carpels* and *young fruit* minutely pubescent. *Mature fruit* winged, glabrous or minutely pubescent, at length breaking up into 5 cocci; cocci winged, with several spines on the dorsal crest, each terminating in a tubercle-based hair; wings extremely variable in shape, size and texture, often rounded, oblong, narrowed and triangular or subtruncate, transversely striate and with one or several teeth on the margins, more rarely irregularly dentate, never spiny, papery, brittle or coriaceous and tough, minutely pubescent or glabrous, up to 18 mm. long and 10 mm. broad, but often very much smaller and showing mere traces of wings (Fig. V).

South West Africa.—Gt. Namaqualand: Marienthal: March, *Dinter*, 2022; March, *Steyn*, 22555 and 22546. Haribes: 40 km. S.W. of Marienthal, Apr., *Engler*, 6578, 6579, 6592. Garis: Oct., *Hartman*, 155, 155b. Between Packrien and Leberfluss: *Trotha*, 43. Sandverhaar: sand dunes, Febr., *Pearson*, 4693; tiefer sand, Jan. *Dinter*, 1187. Kubub-Flâche: March, *Range*, 232. Seeheim: Apr., *Dinter*, 2956; sandy bed of Fisch river, Apr., *Engler*, 663. Holoog: dry river bed, *Pearson*, 4120. Klein Karas: *Dinter*, 5101. Great Karasberge: Noachabeb, 1918, *Blank*, s.n. Keetmanshoop: *Fenchel*, 29. Sandfontein: *Wilman*, 2177. Satansplatz: *Dinter*, 2042; Ariamsvlei, farm Walserbrunn, *Ortendahl*, 316. Orange River: Gaidib, Dec., *Dinter*, 5138. Without precise locality, Afr.: *Fleck*, 26a.

CAPE PROVINCE.—Little Namaqualand: Orange River, Verleptpram, *Drège*. Wortel: Dec., *Pearson*, 3631; without precise locality: *Marloth*, 7809. Kenhardt: Upington, *Moss*, 10730; *Smith*, 2369. Gordonia: without precise locality, *Pole Evans*, 2180. Prieska: Prieska, March, *Bryant*, J. 39. Barkly West: Danielskuil, *Lawson*, *in McGregor Mus.*, 2121.

TRANSVAAL PROVINCE.—Zoutpansberg: Messina, nr. the town, *Young*, *in Hb. Moss.*, 14675.

From the large range of material studied it appears that this species is an annual or at the very most a biennial. The indumentum of the vegetative parts is more pronounced than in other species, especially with regard to the bulbous-based hairs, but this character is inadequate to identify the species in the absence of fruits.

The size of the flowers is extremely variable. *Engler* 6579 has flowers with petals about 8 mm. long whereas *Pearson* 4693 has such of over 15 mm. in length; in fact they may reach a length up to 20 mm. The colour, however, appears to be consistently a pure though a somewhat pale yellow.

In fruiting characters the species, however, is extremely variable, especially with regard to the shape, size and texture, and degree of indumentum of the wings of the individual cocci. The colour of the wings appears to be brown, whereas in *T. cristatus* Presl they are apparently always pale olive-green in colour. The latter character is remarked upon by *Dinter*, who also states that he has never observed a transition from the one to the other. In sheets such as *Dinter* 1187 and *Bryant* J. 39 the extreme variation in the size and shape of the wings may be clearly seen. The texture of the wings is also of a very variable nature; it may be papery and brittle showing all intermediate stages to rigidly coriaceous and tough. This great variation undoubtedly led *Engler* (1915) l.c. to figure and describe (inadequately?) *T. securidocarpus* which he considered to be specifically distinct from our species in question. Under his species he also distinguished forma *vulgaris* and var. *subtruncatus*. Examination of the material of this species and its forms deposited in Herb. Mus. Bot Bérol. has convinced me that neither the forms nor this species created by *Engler* can be upheld, as they fall within the limits of variation of *T. pterophorus*. A further argument in favour of this view is the following: the type *number* of *T. pterophorus* Presl in Herb. Mus. Brit. bears fruits which appear to be almost mature and comparison of these with such of typical *T. securidocarpus* Engl. have led me to believe that both these species are conspecific. *E. Meyer* when working through *Drège's* gatherings of *Tribulus* labelled certain sheets *Tribulus alatus* Delile? thus (inadvertently?) drawing attention to the similarity between the Cape plant and the true but distinct Indian and north-east African *Tribulus alatus* Del. As *Presl's* type of *T. pterophorus* cannot be traced in the *Herb. Un. Germ. Prag.* we have no evidence that this species is distinct from *T. securidocarpus* Engl., but the fact that the *type numbers* of *T. pterophorus* in both Herb. Kew and Herb. Mus. Brit. agree perfectly with the latter species and also with *Engler's* figure of *T. securidocarpus* is sufficient evidence to regard them as being conspecific.

T. albescens Schlechter ex Dinter l.c. is only more densely hispid than typical *T. pterophorus* Presl. It agrees in fruiting characters with, and therefore is also conspecific with the latter.

T. alatus Del., *T. macropterus* Boiss. and *T. pterocarpus* Ehrenb. are the nearest allies of *T. pterophorus*. *T. alatus* Del. and *T. macropterus*, however, both have smaller flowers, intrastaminal glands which are not joined to form a shallow cup at the base of the ovary and fruits with smaller and shorter wings. *T. pterocarpus* Ehrenb. has extremely small flowers with petals about 5 mm. long and the fruits, including wings, do not exceed 10 mm. in both length and diameter, characters by which it is readily distinguishable from *T. pterophorus*.

Dinter (1927) l.c. states that *T. pterophorus* and *T. securidocarpus* are undoubtedly closely related species, but never show transitions between each other. I have had the privilege of studying a wide range of material, my observations have led me to the following conclusions. The extreme forms included under the two species can definitely be distinguished but since every degree of variation and in many cases great variation in the shapes of the fruits on one and the same plant can be observed, the question arises whether we are dealing with two distinct species and their numerous intermediates due to hybridisation. It is possible that *T. securidocarpus* may prove to be a hybrid of the parentage *T. pterophorus* on the one hand and *T. Zeyheri* or an allied species on the other, but this can only be proved by breeding experiments. The figure in Engler l.c. of *T. pterophorus* does not agree in shape with the fruits of the type numbers I have studied; should *T. pterophorus* Engl. (*non* Presl.) eventually be recognised as a distinct species, it will have to receive another name.

In order to decide with absolute certainty whether *T. pterophorus* Presl is an extremely variable species or includes more than one closely allied species with tendencies towards hybridisation, careful breeding experiments will be necessary. As I have had neither the opportunity of studying these plants in the field nor undertaking breeding experiments, my deductions are based on the study of herbarium material, and such conclusions I have reached and the views which are being forwarded here may later prove to be quite erroneous.

The distribution of the species is a fairly limited one. It is fairly frequent in the sandy parts of the Mandate of South West Africa and its southernmost limit appears to be approximately the Orange River basin. It has not yet been recorded from as far north as Angola.

A note on *Blank* s.n. (*leg. anno* 1918) *in Herb. Mus. Bot. Berol.* says " Aufschlag, das erste nach dem Sommerregen spriessende Grün, wachst überall und wird, besonders im jungen Zustande, von allem Vieh gern gefressen. Wenn die Samenkapseln gelb werden, sollen sie Schuld en der ' Geelsiekte ' der Schafe sein. Das Fett der an dieser Krankheit verendeten Schafe ist durchweg gelb . . . ", an indication that this species is suspected of causing " geeldikkop " ? in sheep.

4. **T. Zeyheri** Sond., in Fl. Cap. I. 353 (1859–1860); Dinter, Deutsch-Südwest-Afrika. 85 (1909); Heering & Grimme, Unters. Weideverh. Deutsch-Südwestafr. 27 (1911); Glover, in Ann. S. Afr. Mus. IX. iii. 170 (1913); Engler, Veg. der Erde 9. III. i. 736 (1915), cum fig. 343Y; Burtt Davy, Flow. Pl. & Ferns I. 187 (1926); Dinter, in Fedde Rep. XXIV. 15 (1927); Engler, Pflzfam. ed. II. 19a. 176 (1931), cum fig. 84 Y; Bremekamp, in Karsten u. Walter: Vegetationsbilder, XXII. 3. 3 (1932), cum fig. 13; Range, in Fedde Rep. XXXVI. 250 (1934).

Syn.: *T. Zeyheri* Sond., var. *hirtus* Schinz, in Verh. Bot. Ver. Brandenb. XXIX, 54 (1887).
T. Zeyheri Sond., var *hirsutissimus* Schinz, l.c.
T. terrestris L., var. *Zeyheri* Schinz, in Bull. Herb. Boiss. II, 187 (1894).
T. Zeyheri Sond., var. *aurantiacus* Dinter, in Fedde Rep. XXIV, 15 (1927).
T. murex Schlechter ex Dinter, in Fedde Rep. XXIV, 14 (1927), nomen subnudum, non Presl, pro parte; Range, in Fedde Rep. XXXVI, 249 (1934).

A prostrate *perennial*. *Branches* prostrate or at length somewhat ascending, radiating from the much branched crown of the rootstock, up to 1 metre long (sometimes even exceeding this length but usually very much shorter) and branched again, more or less hirsute in all vegetative parts with a fine indumentum, with scattered bristle-like bulbous-based hairs; internodes very variable in length, depending on the robustness of the plant, up to 9 cm. long, usually much shorter, striate, terete. *Leaves* unequal; the larger up to 9 cm. long, up to 9-jugate; the smaller up to 5 cm. long, up to 4-jugate; stipules up to

10 mm. long, usually much shorter, narrowly linear-lanceolate to obliquely ovate, acute, ciliate with tubercle-based hairs, more or less pubescent on both surfaces; petiole not winged; leaflets obliquely oblong, acute or ovate acute to slightly obovate abruptly acute, very variable in size and shape, from 4–20 mm. long and 2–11 mm. broad, more or less densely pubescent on both surfaces sometimes almost glabrous on the upper surface and very often conspicuously ciliate with bulbous-based hairs. *Pedicel* 1½ to 2 times as long as the subtending leaf. *Flower-buds* ovate, obtuse or acuminate, up to 8 mm. long. *Sepals* narrowly linear-lanceolate, acute, up to 12 mm. long and 2 mm. broad, unusually densely pubescent without. *Petals* broadly cuneate, up to 25 mm. long, 1·7 to 2·5 times the length of the sepals. *Filaments* up to 3·5 mm. long; anthers up to 3 mm. long. *Style* usually fairly short; stigma slender, pyramidal, about 2½ mm. long, much exceeding the style in length. *Intrastaminal glands* united to form a shallow cup at the base of the ovary. Carpels and young fruit minutely pubescent and hirsute with bristle-like hairs. *Mature fruits* armed or almost devoid of spines, extremely variable in size and shape, at length breaking up into 5 cocci; cocci usually armed with 4 (–6) well developed spines, or spines very much reduced as to give the coccus almost a warted appearance, tubercled on the dorsal crest and very often laterally compressed (Fig. VI).

DAMARALAND.—Grootfontein: Jan., *Lightfoot*, 63; Febr., *Seiner*, 674; Jan., *Schoenfelder*, 488. At Gaub: *Borle*, 50. Okahandji: *Dinter*, 143, 303; *Bradfield*, 412; *Hopfner*, 53, 52. Swakopmund: *Bradfield*, 581; *Lüderitz*, 148. bei Ukib: *Dinter*, 60; *Pogge*, 15. Onguati: *Engler*, 6191. Salem: *Dinter*, 110. Karibib, *Hartman*, 155a, 155c pro parte; *Mücke*, 7. Auasberge: *Dinter*, 1888. Windhuk: *Rogers*, 29766. Rehoboth: *Fleck*, 150, 592. Kuiseb-bed: *Fleck*, 776.

GREAT NAMAQUALAND.—Gibeon: *Pearson*, 9212. Sandverhaar: *Range*, 942. Kuibis: *Range*, 897. Aus: *Schäfer*, 156; *Schinz*, 1121. Huibplateau: *Schenck*, 207, 211. Holoog: *Pearson*, 4120. Aias: *Pearson*, 8039. Klein Karas: *Örtendahl*, 250. Choaberib: *Pearson*, 9461.

CAPE PROVINCE. Namaqualand: Rietfontein, *Pearson*, 3434. Kamabies: *Pearson*, 3780. Springbok: *Godman*, 689; *Salter*, 4577. Calvinia: Springbokkuil, *Zeyher*, 272 (type in Herb. Mus. Bot. Stockholm). Calvinia: *Marloth*, 10187. Gordonia: Upington, *Wagner*, s.n. Askkam: *Lang*, s.n. Laingsburg: Matjesfontein, *Foley*, 192. Graaff Reinet: Kruidfonteinhoogte, *Bolus*, 836. Prieska: *Bryant*, J.21, J.39, J.19. Hopetown: Orange River nr. Hopetown, *Bolus*, 1836; *Rehmann*, 3336. Herbert: St. Clair, Douglas, *Orpen*, 124. Kimberley: Witpan, *Pocock*, s.n. Barkly West: *Benim*, 607. Groot Boetsap: *Marloth*, 1133. Likat: *Wilman*, s.n. Winters Rust: *Wilman*, s.n. Kuruman: 50 miles from Kuruman, *Lang*, s.n. Batlharos: *Silk*, 15.

ORANGE FREE STATE.—Fauresmith: *Henrici*, 2557.

TRANSVAAL PROVINCE.—Zoutpansberg: Blaauwberg: *Bremekamp* and *Schweikerdt*, 120. Mapagoni: *Breyer*, *in Hb. Transv. Mus.*, 16044. Messina: *Rogers*, 19373, 19401, 18422; *Scholtz*, 1. Zoutpan: *Obermeyer*, *Schweickerdt* and *Verdoorn*, 263, 299. Waterpoort: *Obermeyer*, *Schweickerdt* and *Verdoorn*, 325. Lydenburg: Sekukuni, *Barnard*, 186.

Sonder in *Fl. Cap.* I. l.c. based his description of the above species on one gathering only; i.e. *Zeyher* 272 from Springbokkuil, Little Namaqualand. Examination of the type numbers of this species in various herbaria suggested that it is an annual, the crown of the rootstock not being strong enough to give one the impression of a perennial species. Sheets such as *Pearson* 3780, 3015, 9212 and 3434, and *Marloth* 1133 which are good matches with the type, however, have rootstocks in which the crown exhibits the presence of remains of dry shoots from an earlier season. Observations of this species in the field in the sandy areas of the northern Transvaal (during the month of November) showed the presence of persistent rootstocks (with the remains of withered and dried branches) giving rise to young flowering shoots. This species is thus undoubtedly perennial but very probably may reach the flowering stage within a year.

Sonder's type is undoubtedly a specimen which grew under unfavourable circumstances. In endeavouring to find a match with this type among more recently gathered material it was found that stunted and dwarfed plants such as *Pearson* 3780 and *Marloth* 1133 approached the type most closely, whereas more robust gatherings such as *Dinter* 303 and *Pole Evans* 1, at first sight, did not appear to belong to this species. Furthermore, luxuriant specimens such as *Schweickerdt* and *Verdoorn* 650, and *Obermeyer, Schweickerdt* and *Verdoorn* 299 at first sight appeared wholly out of place in this species. Careful examination of vegetative, floral and fruit characters, however, have subsequently shown, that all these exhibit such a wide range of variation that a sub-division based on these characters would amount to the description of individual plants as species. It therefore became obvious that owing to the great variation in the specimens examined, the adoption of a broad view of the species seemed the only one possible.

From the appearance of the specimens examined, the notes made by different collectors and from my own observations of plants in the field, it appears that the habit of this species is a fairly constant one: the primary branches arising from the crown of the rootstock are prostrate and towards their extremity may be ascending, but the species never tends to become shrubby as in *T. excrucians* Wawra. It is by this character (supported by others less conspicuous) that these two species may be distinguished.

A study of the characters of the vegetative and reproductive organs, i.e. length of internodes, size of leaflets, degree of indumentum, relative and actual size of calyx and corolla, nature of the fruit, etc., showed *T. Zeyheri* to be an extremely variable species, the limits of which are not at all clearly defined. In fact it is only with great difficulty and uncertainty that it may be distinguished from *T. cistoides* L. *Sonder* l.c. states that *T. cistoides* is " much more robust and has larger leaves, flowers and fruits, besides a style 2 lines long and a short terminal stigma, by which character as already stated by *Schlechtendal Bot. Zeit.* 1851, p. 844, it is known from other *Tribuli*." This statement holds good for *Sonder's* type and a few modern gatherings of stunted plants which are in no way truly representative of the species. As soon as a broader view of the species is adopted it is a matter of difficulty to distinguish our South African species from the American *T. cistoides* L. Examination of material of the latter from America, Cape Verde Islands and Tropical Africa, etc., has shown that in many cases the style is extremely well-developed and the stigma very much reduced; in other cases, however, a pyramidal well-developed stigma and consequent reduction in the length of the style is exhibited by the American plants. The character of relative size and length of style and stigma thus does not hold good as a means of distinction between *T. Zeyheri* and *T. cistoides*. The shape of the leaflets, however, appears to be more satisfactory, viz. in *T. cistoides* they tend to be oblong to obovate-oblong apiculate, whereas in *T. Zeyheri* they tend to be more or less oblong or ovate-oblong. The fruits of these two species do not exhibit any constant differences.

From the foregoing observations it is assumed that these two species are closely related. Whereas extreme forms of these species may be readily distinguished, occasions arise when one is rather somewhat in doubt as to the identity of a plant expecially when it has come from an area where both species overlap, i.e. some parts of Tropical Africa.

To take a restricted view of the above species would not further the position in any way. It would merely mean that certain individuals would have to remain unclassified. To regard *T. Zeyheri* and *T. cistoides* as being conspecific would amount to extending the limits of the species too considerably. *Oliver* in Fl. Trop. Afr. I. 283 (1868) considers *T. cistoides* L. to be a variety of *T. terrestris* L. This is very unlikely to be true for the following reasons. The flowers of *T. terrestris* L. (from Southern Europe) possess intrastaminal glands which are free and not joined to form a definite cup around the base of the ovary, whereas *T. cistoides* L. shows the presence of this cup. This characteristic appears to be of great taxonomic inportance as in the many sheets examined I have always been able to distinguish *T. terrestris* L. (including *T. parvispinus* Presl and *T. murex* Presl) from the other South African members of this genus.

Schinz l.c. after having studied a large number of specimens from the Mandate of South West Africa, arrives at the conclusion that *T. Zeyheri* is to be regarded as a variety of *T. terrestris* L. I cannot agree to this view on the grounds that *T. Zeyheri* has intergrown intrastaminal glands whereas in *T. terrestris* these are free. *Schinz* furthermore states that he had not yet seen *T. cistoides* from Africa, but regards all plants so-named from that continent to be *T. Zeyheri*. In Herb. Kew., however, several sheets from Tropical Africa undoubtedly belong to *T. cistoides* L., in fact they resemble the typical South American form of that species.

Dinter, in *Deutsch-Südwest-Afrika* l.c. states that *T. Zeyheri* differs from *T. terrestris* only in the very large flowers and which are extremely variable in colour. This fine collector evidently overlooked the nature of the intrastaminal glands.

Engler, *Veg. der Erde* l.c. considers *T. cistoides*, *T. terrestris* and *T. Zeyheri* to be distinct and from a phylogenetic point of view equivalent species. He distinguishes *T. Zeyheri* from *T. cistoides* in the following characters: *T. cistoides* has smaller flowers, broader sepals and larger fruits than our plant. These characters appear to be of little or no taxonomic value since I have examined many sheets of *T. Zeyheri* with flowers smaller and fruits larger than those of the American species.

Dinter, in *Fedde Rep.* XXIV l.c. again stresses the variation in colour of the flowers which can be either uniformly yellow, cream with a saffron claw or more rarely, uniformly cream, and in the region of the Aviser Pforte nr. Windhoek very frequently orange-yellow to orange-red. On the basis of the latter colour he distinguishes var. *aurantiacus* Dtr. l.c. from the typical plant. I very much doubt whether this represents a distinct variety and for the present am inclined to consider it synonymous with *T. Zeyheri* Sond.

Schinz's varieties *hirtus* and *hirsutissimus* of *T. Zeyheri* are in my opinion only extremely hairy individuals of the typical plant. I do not consider degree of indumentum to be of any taxonomic importance.

T. murex Schlechter l.c. definitely falls within the range of *T. Zeyheri*. *Dinter* 110 which bears " typ. auct." in *Schlechter's* hand has extremely spiny fruits and it was no doubt on the basis of this character that *Schlechter* had intended to separate it from *T. Zeyheri*.

The fruits of *T. Zeyheri* appear to vary markedly in their degree of spinosity. *Bradfield* 581 and *Dinter* 303, both from South West Africa, exhibit fruits which are extremely spiny and in this respect are not unlike immature fruits of the Australian *T. hystrix* R. Br. The fruits of *Bryant* J. 21, *Mücke* 52, *Schoenfelder* 488 and *Steyn* 22566 again present the other extreme in which the cocci are laterally much compressed and warted on the dorsal crest; the spines are short and rigid. In fact the fruits of the specimens just mentioned appear so typical, that may be on the basis of this character it would be possible to regard them as a species distinct from *T. Zeyheri*. It will be necessary, however, to grow plants from such seed before any conclusions are arrived at. Another most interesting gathering is that of *Bryant* J. 39 (see also under *T. pterophorus*) which has fruits partly devoid of spines and in which the cocci are sharply tubercled as well as having two slender downward turned spines arising from near the base of each coccus. These fruits are not unlike the figure representing *T. Zeyheri* in Engl. l.c. (True *T. Zeyheri* Sond. possesses fruits in which each coccus is armed with four well-developed spines.)

Until an intensive study of the various variations outlined above has been made in the field in conjunction with breeding experiments, it will be impossible to say whether several varieties or even species are involved under the present concept of *T. Zeyheri* Sond., or whether this species is only one *extremely variable* species. The distribution is a much wider one than that of any of the large-flowered South African species. It is found mainly in the sandy arid and sub-arid regions of Southern Africa and occurs further north through South Tropical Africa, finally overlapping with *T. cistoides* L. in the Tropics proper.

5. **T. terrestris** Linn., Sp. Pl. 387 (1753); Thunb. Prodr. 79 (1794); Thunb. Fl. Cap. ed. Schult. 543 (1823); DC. Prodr. I. 703 (1824); Eckl. & Zeyh. Enum. Pl. 95 (1835); Harvey, Gen. S. Afr. Pl. 46 (1838); Drège Zwei Pflzgeogr. -Doc. 58, 73, 131 (1843); Krauss in Flora 1844, p. 301; Sonder, Fl. Cap. I. 352 (1859–1860); Harvey, Gen. S. Afr. Pl. ed. II. 36 (1868); Engl. et Gilg., in Warburg Kunene-Samb.-Exped. Baum: 269 (1903); Dinter, Deutsch-Südwest-Afr. 85 (1909); N. E. Brown in Kew Bull. 1909, p. 97; Heering & Grimme, Untersuch. Weideverh. Deutsch-Südwestafr. 26, 74 (1911); Glover, in Ann. S. Afr. Mus. IX, iii, 170 (1913); Engler, Veget. der Erde 9. III. i. 736 (1915), cum fig. 343, E–L; Juel, Plant. Thunberg. 309 (1918); Burtt Davy, Flow. Pl. & Ferns I. 187 (1926); Dinter, in Fedde Rep. XXIV. 15 (1927); Engler, Pflzfam. ed. 2. 19a. 176 (1931), cum fig. 84 E–L; Range, in Fedde Rep. XXXVI. 250 (1934).

Syn.: *T. terrestris β. desertorum* Eckl. and Zeyher, Enum. Plant, 95 (1835).
T. hispidus Presl, Bot. Bemerk., 29 (1844).
T. murex Presl, l.c.
T. parvispinus Presl, l.c.
T. terrestris L., var. δ. *desertorum* Sond., Fl. Cap. I, 353 (1859–60).
T. terrestris L., var. β. *hispidissimus* Sond., Fl. Cap. I, 353 (1859–60); Burtt Davy, Flow. Pl. and Ferns I, 187 (1926).
T. parviflorus Schlechter ex Engler, Pflzfam. ed. II, 19a, 176 (1931), nomen tantum.
T. murex Schlechter ex Dinter, in Fedde Rep. XXIV, 14 (1927) pro parte, nomen subnudum, non Presl; Range, in Fedde Rep. XXXVI, 249 (1934).

A spreading prostrate usually decumbent *annual*. *Branches* radiating from the much-branched crown of the rootstock, up to 1·5 metres long and usually branched again, in all vegetative parts pubescent, villous or hispid or glabrescent, extremely variable as to degree of hairiness; internodes up to 6 cm. long, usually much shorter, terete, striate. *Leaves* unequal; the larger up to 6 cm. long, usually somewhat smaller, with up to 8 pairs of leaflets; the smaller up to 3·5 cm. long, usually much smaller, with up to 6 pairs of leaflets; leaflets obliquely oblong-lanceolate, or lanceolate-ovate, acute or subobtuse, villous on both surfaces, often more or less glabrescent above, up to 15 mm long and 5 mm. broad, usually much smaller; stipules linear or linear-lanceolate, acute, up to 10 mm. long, often much shorter. *Pedicel* shorter, as long as or more rarely slightly longer than the subtending leaf. *Flower buds* ovate-acuminate or acute. *Sepals* 3 6 mm. long, linear-lanceolate, acute, villous without. *Petals* broadly cuneate, clear yellow, 3–12 mm. long, shorter than or up to 2·3 times the length of the sepals. *Filaments* 3 mm. long or somewhat longer. *Style* short, much reduced; stigma hemispherical and almost sessile on the ovary; ovary hirsute with bristly bulbous-based hairs. *Intrastaminal glands* not intergrown to form a cup around the base of the ovary. *Mature fruit* pubescent or almost glabrous, at length breaking up into 5 cocci; cocci usually with 2 lateral divergent acute spines inserted above the middle, and two shorter spines directed downwards and inserted near the base of the coccus; dorsal crest tubercled and usually set with bristly hairs; the size and degree of spinosity of the cocci is extremely variable (Fig. VII).

ANGOLA.—Mossamedes: *Höpfner*, s.n. On the Kubango at Kalolo: *Baum*, 441.

AMBOLAND.—Ondonga: *Liljeblad*, 188; *Rautanen*, s.n. Olukonda: *Schinz*, 1022, 1023, 1025.

DAMARALAND.—Okahandja: *Dinter*, 143; *Seiner*, 150. Windhuk–Walfishbay: *Rogers*, 15179. Salem: *Dinter*, 102. Windhuk: *Trotha*, 81a. Karabib: *Hartman*, 155b, 155c pro parte, 155d. Lichtenstein: *Dinter*, 4489. Rehoboth: *Fleck*, 4, 65.

GT. NAMAQÜALAND.—Kubub: *Range*, 226; *Schinz*, 1024. Schakalskuppe: *Pearson*, 4784. Sandverhaar: *Pearson*, 4675. Seeheim: *Pearson*, 3723. Naruda-süd: *Pearson*, 7862, 8218.

CAPE PROVINCE.—Little Namaqualand: Steinkopf, *Schlechter*, s.n. Stinkfontein: *Pearson*, 5521. Calvinia: Springbokkuil, *Zeyher*, 273. Clanwilliam: *Bachmann*, 332. Nr. Wupperthal: *Drège*. Cape: Claremont, *Schlechter*, 553. Nr. Salt River stn.: *Salter*, 240/11. Nr. Lakeside stn.: *Andreae*, 229. Robertson: Montagu, *Moss*, 5593. Riversdale: Gauritz River: *Ecklon* and *Zeyher*, 751B. Mossel Bay: *Moss*, 5593. Knysna: *Burchell*, 1841; *Fourcade*, 1993. Uitenhage: *Ecklon* and *Zeyher*, 751. Bathurst: Fish River, *Burke*. Komgha: *Flanagan*, 82. Willowvale: Bashee, river mouth and in gardens, *Drège*. Queenstown: Shiloh, *Baur*, 973. Graaff Reinet: *Bolus*, 261. Prieska: *Bryant*, J. 39 pro parte. Hay: Asbestos Hills, *Wilman*, 3041. Herbert: Belmont, *Wilman*, *Orpen*, 125, 126. Kimberley: *Wilman*, 2124. Riverton: *Wilman*, 3041.

NATAL PROVINCE.—Ladysmith: Wagon Hill, *Wood*, 18781. Zululand: *Gerrard*, 214.

ORANGE FREE STATE PROVINCE.—Fauresmith: *Henrici*, 1873, 2461, 2462, 2532-2534, 2559-2561, 2676, 2678, 2704 2706, 2708, 2710 2712, 2718 2719; *Verdoorn*, 1561-1563; *Goossens*, 654; *Steyn*, 22565. Bloemfontein: Bestersput, *Welti*, 22. Modderrivierdrift: *Rehmann*, 3586. Kroonstad: Bothville, *Schweickerdt*, 1075, 1080. Vredefort: *Obermeyer*, *in Tvl. Mus.*, 31665.

TRANSVAAL PROVINCE.—Potchefstroom: *Burtt Davy*, 854. Vereeniging, *Leendertz*, 5862. Witwatersrand: Johannesburg, *Moss*, 7469, 9557, 13779, 16146, 16171. Pretoria: Wonderboompoort, *Smith*, 6192; *Schweickerdt*, 1049, 1050. Rooikop: *Smuts* and *Gillett*, 2029. Meintjes Kop: *Mogg*, 12307; *Schweickerdt*, 1202. Rustenburg: *Nation*, 42 *Watt* and *Brandwyk*, 1813. Waterberg: Nylstroom, *Mogg*, 12535. Zoutpansberg: Messina, *Turner*, 18.

BASUTOLAND.—Leribe: *Dieterlen*, 127. White Hill: *Jacottet*, 236.

BECHUANALAND PROTECTORATE.—Mafeking: *Bolus*, 6402. Mochudi: *Rogers*, 6443. Kwebe (Ngamiland): *Lugard*, 105, 117, 123.

PORTUGUESE EAST AFRICA.—Ressano Garcia: *Schlechter*, 11896. Rikatla: *Junod*, 440. Lourenco Marques: *Moss*, 11806, 6947; *Thoday*, 176; *Monteiro*, 56. Inhambane: *Lawrence*, 31.

For reasons of space it has been impossible to cite all the specimens seen. Consequently gatherings for citation were selected mainly with a view to indicate the wide distribution of this species in South Africa. As a result of studying a very wide range of material from almost all parts of Southern Africa, the writer has come to the conclusion that among the various species of *Tribulus* found in the area under consideration, *T. terrestris* Linn. show the widest range of variation both in vegetative and reproductive characters.

T. murex Presl, *T. parvispinus* Presl and *T. hispidus* Presl based on scanty material are very probably only forms of the cosmopolitan *T. terrestris* L.

T. parvispinus Presl has petals and sepals 2–5 mm. long and in many cases the sepals exceed the petals in length. The ratio of length of petals to sepals may thus be represented by the factor 1·0 or a value less than 1·0.

In *T. murex* Presl the petals vary between 5-12 mm. and sepals 4–6 mm. in length. The ratio of the length of petals to sepals here has a value of 1·25–2·3 and appears to be always greater than 1·0. The flowers appear to be somewhat larger than those of *T. parvispinus*, but specimens have been examined in which the flowers approached in size those of the species just mentioned.

In the type and type numbers of *T. hispidus* Presl the petals have been eaten by insects (probably already at the time of gathering) but judging from the remains they appear to exceed the sepals in length. The very hispid nature of the plant to my mind is merely due to habitat, it does not appear to be of any taxonomic value, since it is not correlated with other distinctive characters.

An attempt to dintinguish *Presl's* species from each other on basis of the relative ratios of length of petals to sepals has proved unsuccessful especially as the Linnean type of *T. terrestris* in some respects appears to be intermediate between these species.

The Linnean type of *T. terrestris* is a complete plant having about 5 branches each of which is more or less 8 cm. long. The petals are about 3 mm. long and the sepals being hidden by the former are somewhat shorter than the petals. The leaves are 4–6 jugate, and the pedicels are as long as or slightly shorter than the subtending leaves; the leaflets are up to 7 mm. long and 3 mm. broad. The young fruits are minutely puberulous (apart from the bristly hairs on the dorsal crests) and each coccus is armed with two pairs of lateral spines of which one pair is shorter than the other.

[As a note of interest the following may be mentioned: *Linnaeus* wrote up his type (sheet 4 in the cover of *Tribulus*) as *Tribulus* ▽ which actually means *T. aquaticus.* In the manuscript of the Sp. Pl., however, he correctly wrote Tribulus ⊽ the latter sign being used by him to denote "earth," i.e. *terrestris.* By mistake the sheet was thus actually written up wrongly, but this has no bearing on *Tribulus aquaticus* C. Bauh. which is quite a different plant, namely *Trapa natans* (see Richter's Index)].

Taking various standard works on the Floras of Central Europe, North America and Australia into account, one finds that the limits by which these various authors define *T. terrestris* L. show wide discrepancy. Some define the petals as being "3-4 mm. long," some state "6 mm. long'" and others again "up to 10 mm. long," the length of the sepals also exhibits this wide range of variation. There is thus very little doubt with regard to the extreme variability of this species.

It has been pointed out that the *Linnean* type has extremely small flowers. What *Presl* has described under the name *T. parvispinus* is to my mind typical *T. terrestris* L. The fruit characters on which he distinguishes his species from the Linnean plant do not hold good. A wide range of material has shown the size, etc. of the fruits to be extremely variable. For analogous reasons *T. murex* Presl and *T. hispidus* Presl are considered to be merely large-flowered and more robust forms of *T. terrestris* L.

Dinter 102 quoted in Fedde Rep. XXIV. 14 (1928) under *T. murex* Schlechter is nothing else but *T. terrestris* L. Furthermore *T. parviflorus* Schlechter ex Engler l.c. is *T. terrestris* L.

Miss I. C. Verdoorn of the Division of Plant Industry, Pretoria, who has had occasion to study plants in the field and especially on the lands of the Grootfontien School of Agriculture, Middelburg, Cape Province, recognised three closely allied forms of *Tribulus,* (*a*) small plants with erect dried-up looking (greyish) inward-curling branches, (*b*) plants with longer branches which were inclined to be prostrate, (*c*) luxuriant plants with closely prostrate branches. Miss Verdoorn kindly prepared herbarium specimens of these forms all of which have since been identified by the writer as being *T. terrestris* Linn. These forms could not be regarded as varietally different on basis of their habitat, since the latter was not correlated with any other morphological difference. The small erect "form" was suspected of having caused "dikkop" in sheep.

Dr. M. Henrici, who has grown plants at the Veld Reserve, Fauresmith, O.F.S., states: "At least four species seem to exist according to habit of growth and flowers: (1) a widely spreading plant with a large yellow dark-centered flower, (2) a running variety with a large evenly coloured yellow flower smaller than that of (1), (3) medium sized yellow flower with calyx about half as long as petals, both running and upright forms; when the species runs, calyx may be nearly as long as the petals, (4) small yellow flower with calyx as long as or longer than the petals, running and upright forms. The two latter species have forms not only differing in their habit of growth but also in their content of green pigment. While some of the forms are excellent fattening fodder plants, those which grow upright and contain less pigment cause dikkop at times, especially in the wilted state and on certain soils (limestone and river bank soils). It seems that the species with large flowers and large amounts of pigment and with long runners are never poisonous."

The plants mentioned under (1) and (2) are definitely not *T. terrestris* L. but very probably *T. Zeyheri* Sond. or one of the species with winged fruits. Since the nature of the fruits is not mentioned it is impossible to say which of these species are involved. The plants under (3) are probably luxuriant forms of *T. terrestris* L. (= *T. murex* Presl) and those under (4) almost certainly the typical small-flowered Linnean species. It may be added that according to a note by *Blank* on a sheet of *T. pterophorus* Presl in Herb. Mus. Bot. Berol., this large-flowered prostrate species has been found to cause " geelsiekte " in sheep (see notes under *T. pterophorus*). Thus not only the small-flowered species are to be suspected of being poisonous to sheep.

T. terrestris L. makes its appearance soon after the first summer rains have fallen and often forms extensive dense carpet-like growths near the habitations of man.

Owing to the ruderal and semi-ruderal nature and the wide (almost cosmopolitan) distribution of this Linnean species it is readily conceivable that under different edaphic and climatic conditions the plants may present a very variable appearance. Careful breeding experiments would do doubt throw light on the question as to whether *T. terrestris* L. as conceived in this paper is only one extremely variable species or whether at present several closely allied species are included under this name.

CONCLUDING REMARKS.

That distinguished systematists such as *Engler*, *Schinz* and *Dinter* had failed in defining the limits of the various species clearly, in spite of the fact that each of these authors had travelled and collected extensively in Southern African regions where *Tribulus* abounds, may serve to indicate how ill the members of this genus are defined.

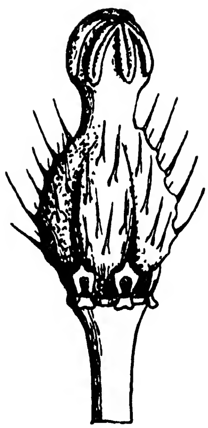
A successful and clear delineation of the Southern African species may be possible by taking recourse to special field studies including the growing of plants from seed and the conduction of breeding experiments. A clear conception of the range of variation exhibited by any one species may be obtained in this way.

It is furthermore a *sine qua non* that thorough gatherings be made of such mother plants in both flowering and fruiting condition of which the seed is intended to be grown. Such mother plants must be retained for future reference and as a standard for comparison with the cultivated daughter plants. The mere growing of plants from seed without having preserved specimens of the mother plants from which the seed had been derived is not of much use, since it is absolutely essential that the nature of the original plant in its wild state be known.

The most satisfactory and profitable method of procedure appears to be the following: As many different forms of species such as for example *T. pterophorus*, *T. Zeyheri* and *T. terrestris*, including specimens of these species from their type localities (where such are known) and which have been found to resemble the type, should be gathered and their seeds should be grown under identical as well as different conditions (climatic and edaphic). Gatherings should again be made of both flowering and fruiting material of these daughter plants. By subsequent comparison of these individuals possibly an insight may be gained into what at present is considered to be an individual but very variable species.

ACKNOWLEDGEMENTS.

It has been my privilege to examine the material in all the South African Herbaria as well as the Southern African material in the following European Herbaria: Hort. bot. Reg. Kew., Mus. Brit., Mus. bot. Berol., Mus. bot. Stockholm, Mus. bot. Univ. Germ. Prag., Mus. bot. Univ. Zürich and Hofmuseum, Wien. I wish to tender my sincere thanks to the Directors and Curators (Keepers) of these various institutions for allowing me to consult this material. My special thanks are due to Sir Arthur Hill, Director of the Royal Botanic Gardens, Kew, for the great facilities offered during the preparation of this paper.



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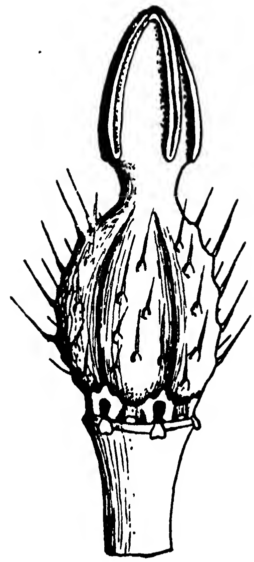

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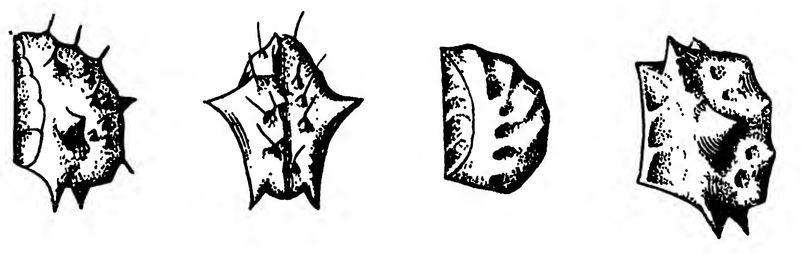

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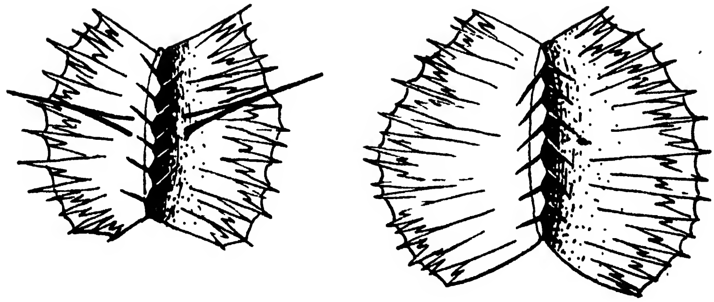

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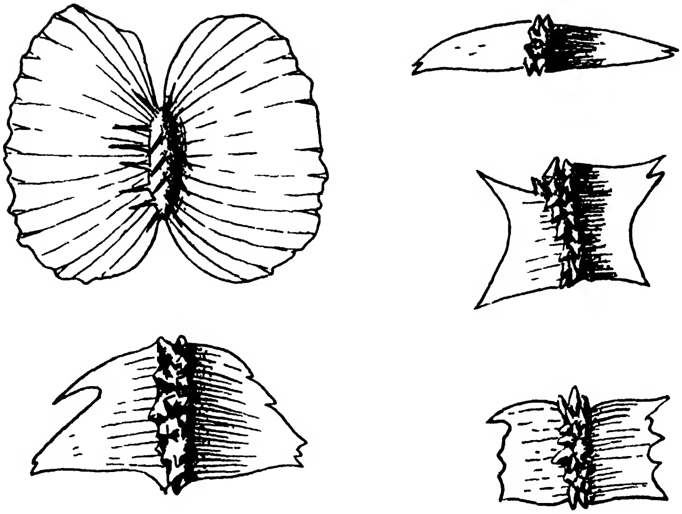

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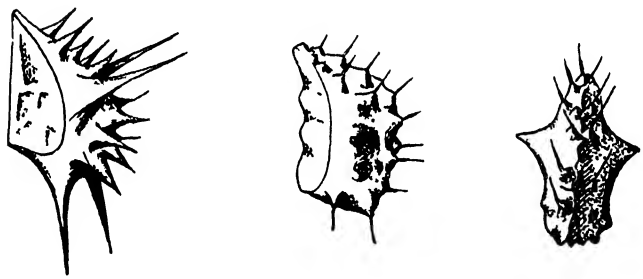

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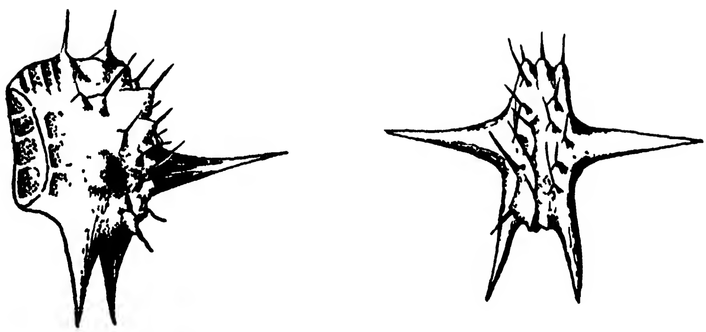

VII

EXPLANATION OF FIGURES.

I.—Ovary of *T. terrestris* L. (× 10).

II.—Ovary of *T. Zeyheri* Sond. (× 10).

III.—Cocci of *T. excrucians* Wawra (× 3).

IV.—Cocci of *T. cristatus* Presl (× 2).

V.—Cocci of *T. pterophorus* Presl (× 2).

VI.—Cocci of *T. Zeyheri* Sond (× 3).

VII.—Cocci of *T. terrestris* L. (× 3).

A NOTE ON THE SOUTH AFRICAN SPECIES OF *XIMENIA* LINN. AND THEIR POSSIBLE ECONOMIC USES.

By H. G. Schweickerdt, B.Sc., Ph.D., F.L.S.

During the past seventeen years spasmodic interest has arisen in connection with the possible use of the fruits of species of *Ximenia* as a source of oil. In 1917 the Imperial Institute reported on a sample of fruits said to be those of *X. americana* Linn. Last year Mr. A. G. S. du Toit, the Extension Officer at Ixopo, Natal, sent in specimens of a *Ximenia* (National Herbarium No. 16694) accompanied by a large sample of fruits, with a request for any information as to their economic value. Mr. du Toit in his letter stated that the plant grows on very poor dry land—practically useless for any other plant of value and that the fruits could be gathered in large quantities. In South Africa we have two species of *Ximenia* which have always been confused and because of the interest taken in the plants, it was thought desirable to clear up the confusion, as it was important to know which of the two species were investigated and reported on by the Imperial Institute. The work was commenced at the National Herbarium, Pretoria and completed at the Herbarium, Royal Botanic Gardens, Kew.

Oliver in the Fl. Trop. Afr. 1, p. 346 (1868), mentions one species, *X. americana L.* and one variety, *X. americana var. microphylla Welw.* Sonder in the Fl. Cap. 1, p. 234 (1859), likewise mentions only one species *X. caffra Sond.* and one variety, *X. caffra var. natalensis Sond.* The fundamental difference between *X. americana* L. (and the variety *microphylla* Welw.) and *X. caffra* Sond. (and the variety *natalensis* Sond.) may be found in the type of inflorescence.

The following diagramatic drawings may serve to illustrate the morphology of different types of inflorescences met with in the South African species and varieties of *Ximenia L.* For the sake of clarity these diagrams have been somewhat exaggerated especially with regard to the dimensions of the abbreviated shoots (B) in Figs. I. II. III.

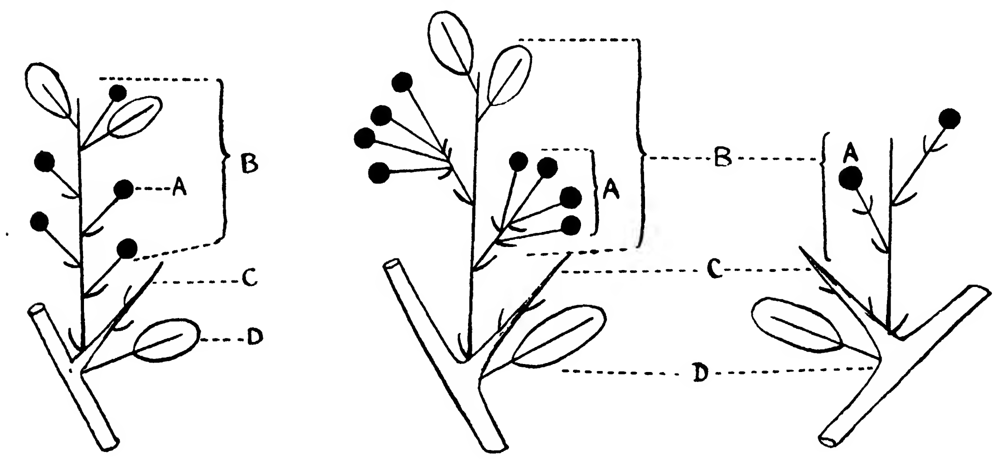

FIG. I. FIG. II. FIG. III.

In *X. americana* the inflorescence is always a stalked axillary few- to many-flowered bracteate cyme. In *X. americana var. microphylla* the inflorescence is also a few-flowered stalked and bracteate axillary cyme; occasionally however, the flowers may be solitary, but then the peduncle is always bracteate, thus suggesting a reduced inflorescence. In *X. caffra* and *X. caffra var. natalensis*, however, each flower arises singly in the axil of either a scale-like leaf or in the axil of a normally developed leaf; the pedicels are never bracteate. A number of these flowers usually arise on one and the same much abbreviated lateral shoot thus forming an axillary fascicle. By the foregoing characters *X. caffra* (and its variety) may readily be distinguished from *X. americana* (and its variety).

A study of herbarium material has shown, that the inflorescence Fig. II (A), or solitary flowers Fig. I and Fig. III arise in the axils of either (i) normally developed foliage leaves, or (ii) in the axils of reduced scale-like leaves borne by shoots of limited growth (B). These dwarf shoots (B) are usually much abbreviated and consequently the facicles of flowers in *X. caffra* (and its variety) may readily be mistaken for sessile axillary cymes. The abbreviated shoots in turn arise in the axils of either (i) normally developed foliage leaves, or (ii) in the axils of the lower scale-like leaves, on lateral branches of limited growth (C); the latter may either be so much abbreviated as to resemble warty outgrowths or may be relatively well-developed thorns. The thorns invariably arise in the axils of normally developed leaves (D). The latter may have fallen by the time the inflorescence develops, but this is by no means always the case. Furthermore the leaves on the shoots (B in Figs. I and II) do not always develop and consequently may be absent. In other cases again the bracts subtending the flowers (Fig. I) or those subtending the cymes (Fig. II) may be replaced by normally developed leaves.

Burtt Davy in his Manual of Flowering Plants and Ferns of the Transvaal with Swaziland II, p. 453 (1932) seems to have overlooked the fact that *X. americana* L. and *X. caffra* Sond. are readily distinguishable by their type of inflorescence. In fact this character is of fundamental importance in the distinction of species (and varieties) belonging to this genus.

It is therefore suggested that the following key to the Transvaal species (and varieties) be substituted for the one on page 453 of Burtt Davy's manual (l.c.)

A.—Flowers solitary in the axils of normal or scale-like leaves, or in few- to many-flowered fascicles on abbreviated branches. Flower-stalks never bracteate near the middle..B.

Inflorescence a few- to many-flowered stalked axillary bracteate cyme, or flowers solitary arising in the axils of leaves, but then the flower-stalk always bracteate near the middle..C.

B.—Branchlets and leaves densely tomentose when young; lamina becoming glabrate above in age (even quite glabrous and shiny); petioles, peduncles, calyx and outer surface of the corolla pubescent, the latter at times almost glabrous..*X. caffra* Sond.

Branchlets and leaves glabrous to tomentose when young; lamina in age above and beneath glabrous, but never shiny; petioles pubescent; peduncles and calyx scantily pubescent or glabrous; corolla externally glabrous..*X. caffra var. natalensis* Sond.

C.—Leaves glabrous, but not conspicuously glaucous; lamina $3\frac{1}{2}$–$7\frac{1}{2}$ cm. long, 2–$3\frac{1}{2}$ cm. broad; flowers 0·8–1·25 cm. long; calyx not deeply lobed; fruits $2\frac{1}{2}$–3 cm. long, yellow when mature..*X. americana* L.

Leaves glabrous, conspicuously glaucous; lamina up to $3\frac{1}{2}$ c.m long and up to 2 cm. broad, but usually much smaller; flowers 5–6 mm. long; calyx persistently deeply lobes; fruit up to 2 cm. long, yellow when mature; plants usually very thorny..............................*X. americana var. microphylla* Welw. ex Oliv.

According to Burtt Davy l.c., *X. americana* L. occurs in the bushveld and Barberton areas of the Transvaal. Examination of specimens quoted in his manual, has proved these to belong to *X. caffra var. natalensis* Sond. As it may easily be seen from the above key that the latter plant is entirely distinct from *X. americana* L., Burtt Davy's synonomy *X. americana* L. — (*X. caffra* var. *natalensis* Sond.) is not justified ; it is merely the result of erroneous identification of specimens. Furthermore in the " Notes from the National Herbarium and Museum, Series No. 4, Journ. Dept. Agr., South Africa, January, 1925 " the plant in question (Nat. Herb. No. 2840) is definitely not *X. americana* L. but *X. caffra* Sond.

All the available material from the Transvaal I have so far had an opportunity to examine, did not include any belonging to *X. americana* L. This species in its typical form apparently does not occur in the Transvaal or even in the Union of South Africa.

With regard to *X. Rogersii* Burtt Davy : This species is described by Burtt Davy in his Manual 11, p. xxxv (l.c.). A description of the inflorescence is not given. Examination of the type specimen (*Rogers* 22569 in Herb. Kew.) showed, that it agrees perfectly with the type of *X. americana* var. *microphylla* Welw. ex Oliver (*Welwitsch* 1127 in Herb. Mus. Brit.). Burtt Davy does not, however, quote this variety as a synonym of his species *X. Rogersii.* Whether the plants placed in *X. Rogersii* and therefore also those placed in the variety of *X. americana* are sufficiently distinct from *X. americana* to constitute a separate species is at present difficult to say. They are undoubtedly closely allied to that species and the only character by which they may be readily distinguished appears to be the difference in length of the petals of the flowers. Until more complete material, better field-notes and a much wider range of material can be studied it is perhaps more satisfactory to retain *X. americana* var. *microphylla* Welw. ex Oliver in preference to *X. Rogersii* Burtt Davy. It is also suggested that the enumeration of species and varieties of *Ximenia* L. on p. 453-454 of Burtt Davy's Manual be modified as follows :—

(1) *X. caffra* Sond.
(2) *X. caffra* var. *natalensis* Sond.
(3) *X. americana* var. *microphylla* Welw. ex Oliver - (*X. Rogersii* Burtt Davy).

The fruits sent to the Imperial Institute in 1934 were those of *X. caffra* var. *natalensis* (National Herbarium 16694) and examination of the herbarium material now proves that the samples of fruits examined by the Imperial Institute in 1917, were not those of *X. americana* but of *X. caffra* (National Herbarium 2840).

The following is an extract from the report of the Imperial Institute :—

" As previously mentioned it seems unlikely that the oil could be prepared by pressing the kernels, and solvent extraction would be necessary. The oil obtained in the present case by extraction with light petroleum resembled the similarly-prepared oil from the *X. americana* (i.e. *X. caffra*) kernels in being viscous and cloudy, and in containing an appreciable quantity of a rubber-like constituent, the presence of which would account for the high viscosity of the oil. Such oil could not be used for edible purposes and would probably prove unattractive for the manufacture of soap in competition with other readily available oils. Its comparatively low iodine value indicates that it would be unsuitable for use in paint and varnish-making. The acetone-extracted oil, on the other hand, proved to be practically free from the objectionable rubber-like substance. It might therefore prove more suitable for soapmaking and possibly, after refining, for edible use. The value of such oil at the present time would, however, be only about £13 to £14 per ton in the United Kingdom. The residual meal is rich in proteins, but feeding trials carried out in Germany on several kinds of animals with the residual meal of *X. americana* kernels are stated (*Der Pflanzer*, 1911 7, 486) to have shown that the meal is not well suited for use as a feeding-stuff. The present meal would probably give similar results, but feeding trials would be necessary

to determine this point. In this connection it may be pointed out that the meal left after extraction with acetone would contain most of the rubber-like constituents of the kernels, and this might affect its suitability for use as a feeding-stuff. Owing to the inferior quality of *Ximenia* kernels in comparison with other oil-seeds and in view of the current over-production of vegetable oils generally and the consequent low price of these commodities, it does not appear likely that under existing conditions it would be profitable to exploit Ximenia kernels as a source of oil, except possibly for local markets. It may be mentioned in connection with any effort which may be made to utilise Ximenia oil in South Africa, that the kernels can be readily extracted from the dry fruits by treatment in a Miller's palm-nut cracking machine, and subsequent separation by means of sieves and an air-blast such as are employed in machines used in the preparation of palm kernels."

A NEW SPECIES OF *PACHYSTIGMA* HOCHST. FROM TRANSVAAL.

By Prof. Dr. W. Robyns, Brussels (Belgium).

The genus *Pachystigma* has its centre of dispersion in South Africa. Of the ten known species, only two are to be found in Southern Rhodesia : *P. rhodesianum* (S. Moore) Robyns, which is limited to that country and the very poisonous *P. pygmaeum* (Schlecht) Robyns, a native of South Africa but extending into Southern Rhodesia.

Several species show that suffrutescent habit which is so commonly met with in South Africa,* but others are dwarf shrublets or erect and more or less branched shrubs of 2–4 m. high, as *P. Bowkeri* Robyns and *P. macrocalyx* Robyns. The second species is perhaps the most variable of the whole group in its vegetative characters as a result of response to local conditions. Amongst rocks, it shows the dwarf squat habit with short internodes and small subtomentose more or less fulvous leaves (forma rupicola), whereas on the edge of forests, it develops into a much branched shrub with elongated internodes and large puberulous green leaves (forma silvicola). The extreme forms of this species look so different that one may easily be inclined to consider them as two distinct species, but the differences seem to be only of degree, no qualitative characters being available.

The new species from Northern Transvaal described here through the courtesy of Dr. E. P. Phillips, Principal Botanist, Pretoria, who kindly sent the herbarium specimens for examination to Brussels, is, according to the collector's label, a small tree of about 5 m. (15 feet) high. Its affinities are with *P. macrocalyx* on account of the habit and the long calyx lobes. It may be incorporated in the key I have published in 1928† as follows :—

Folia utrinque tomentosa vel rarius dense appresse pilosa ; alabastra ut calycis lobi pubescentia :

- Folia anguste elliptica, tantum usque ad 1 cm. lata ; cymae distincte pedunculatae, pedunculo 3–5 mm. attingente :
  - Frutices nani ; folia 3 cm. longa et 1 cm. lata, cyanescentia pilosaque ; cymae 3-5-florae ; calycis lobi lineares, vix tertiam partem superiorem alabastrorum attingentes.................. *coeruleum*
  - Arbores parvi, breviter ramosi ; folia usque as 1·7 cm. longa et 0·8 cm. lata, cinereo-tomentella ; cymae 3-florae ; calycis lobi anguste elliptici et alabastra plus minusve aequantes......... *triflorum*
- Folia rotundata, ovato-rotundata vel elliptico-rotundata, semper ultra 1 cm. lata ; flores subfasciculati vel rarius ad cymas brevipenduculatas referentes ; calycis lobi lineari-obtusi et alabastra aequantes vel superantes.................................... *macrocalyx*

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* cf. *J. Burtt Davy*.—The suffrutescent habit as an adaptation to environment. Journ. of Ecology, X, p. 211 et sqq. (1922).

† *W. Robyns*.—Tentamen Monographiae Vangueriae Generumque affinium. Bull Jard. Bot. Etat Brux., XI, p. 119 (1928).

Pachystigma triflorum *Robyns* sp. nov., ex affinitate *P. macrocalycis*, sed habitu, foliis ellipticis multo minoribus et calycis lobis ellipticis primo visu distinctum.

Arbor parva, secundum collectores ± 5 m. alta, multo sed breviter divaricate ramosa ; rami ramulique oppositi, cylindracei, cortice cinereo interdum subdeciduo obtecti, glabri ; ramuli novelli breves, oppositi, divaricati, teretes, internodiis brevibus vel usque ad 6–8 mm. attingentibus, dense cinereo-tomentelli. *Stipulae* subherbaceae, brevissime vaginato-connatae, subito 0·5 2 m. longe filiformi-subulatae, omnino cinereo-tomentellae, vix scariosae et demum deciduae. *Folia* ad nodos ramorum hornotinorum opposita, mox decidua, breviter petiolata, petiolo 1-1·5 mm. attingente et griseo-tomentello ; laminae rigide herbaceae, anguste ellipticae, basi breviter attenuatae, apice plus minusve late obtusae, statu sicco marginibus saepe recurvatis, 1-1·7 cm. longae et 0·5–0·8 cm. latae, utrinque tomentellae sed leviter discolores, pagina superiore leviter glaucescentes at pagina inferiore cinerascentes, costa media pagina inferiore distincte prominente, costis secundariis inconspicuis. *Cymae* as nodos ramorum annotinorum plerumque defoliatorum insertae, plerumque oppositae, divaricatae, simplices, typice triflorae sed saepe abortu biflorae vel etiam uniflorae, bracteolatae, omnino cinereo-tomentellae, in toto 1·5-1·8 cm. attingentes, distincte pedunculatae, pedunculo crassiusculo et 3·5 mm. longa. *Flores* mediocres, 3·5 mm. longe pedicellati ; alabastra oblonga, distincte apiculata, circa 6–7 mm. longa et dense pubescentia ; calycis lobi sub anthesin plus minusve patententes, anguste elliptici, apice obtusi, 6 mm. longi, utrinque tomentelli ; corollae tubus cylindricus, ± 2·5 mm. longus, extus dense pubescens, intus medio annulo pilorum reflexorum instructus, lobi lanceolati, appiculati, ± 4 mm. longi quorum 1·5 mm. pro apiculis, extus breviter pubescentes et intus carnosuli ; antherae subsessiles, lanceolatae, breviter apiculatae, 1·25 mm. attingentes ; stylus gracilis, e basi sensim attenuatus, ± 4·5 mm. altus ; stigma cylindricum, apice distincte 5-lobatum, irregulariter costatum, ± 1 mm. longum ; discus annularis, glaber ; ovarium hemisphericum, ± 1 mm. altum, tomentellum et 5-loculare. *Fructus* pedicello elongato suffultus, globosus, apice calycis lobis auctis coronatus, ± 6 mm. diametro (an maturus ?), sicco nigricans, sparse puberulus, 5-pyrenus.

South Africa.—North-Transvaal : Waterberg, Olifant's Poort, at 9 miles north of Nylstroom, in bush on rocky kopje, rare, tree of about 5 m., flowers pale greenish yellow, December, 1934, *Galpin*, 13198 (typus floriferus) (Herb. Pretor. et Herb. Brux.) ; Zoutpansberg Range, January, 1925, *Smuts, in Nat. Herb.*, 19796 (typus fructiferus) (Herb. Pretor.).

Observation.—This new species can easily be distinguished by the xerophytic habit, the ashy-coloured leaves, the typical 3-flowered cymes and the form and length of the calyx-lobes.

A REVISION OF THE SOUTH AFRICAN SPECIES OF *HELITOTRICHON*, *Bess. ex Schultes.*

By H. G. Schweickerdt, B.Sc., Ph.D., F.L.S.

(With 12 Figures.)

I.—INTRODUCTION.

The most elaborate account of the South African species of this genus is that by *Stapf*, in Dyer, Fl. Cap. VII. 172 477 (1899) under the name *Avenastrum* Jess., where a fairly broad view of the species was taken.

Stapf did not consult the actual type specimens of *Steudel* and *Nees ab Essenbeck*, but based his identifications on the study of type numbers. For purposes of study he furthermore had only a comparatively narrow range of material at his disposal. During the last few years, however, a fair amount of material has accumulated in various South African herbaria. Because of this and the foregoing reasons, the author of the present paper found it desirable to undertake a revision of the genus with a view to elucidating several remarks made by *Stapf* in his account of the genus.

In this revision the material of several of the larger European and the more important South African herbaria has been included.

II.—HISTORY OF THE GENUS.

The generic name *Helictotrichon* Bess. first appears in *Schultes Mant. Syst. Veg. ii. Addit. I.* 526 (1827) and most probably is merely a revised spelling of the earlier name *Elictotrichon* Bess. ex Andrz. [Rys. Bot. p. 9 (1823)]. The latter appeared in a list of plants as *Elictotrichon sempervirens* Bess. unaccompanied by any description and being a *nomen nudum* must thus be rejected.

At a date subsequent to the publication of the name *Elictotrichon sempervirens*, *Besser* communicated to *Schultes* a new classification of *Avena* and *Trisetum* in which he proposed several new genera, including *Helictotrichon*. As *Besser* had already used the name *E. sempervirens* for *Avena sempervirens* Host. and as the latter was also the first species to be listed under *Helictotrichon*, *Avena sempervirens* Host. naturally is the type species of the genus.

The name *Avenastrum* first appeared as a *section* to the genus *Avena* L. in Koch, Syn. Fl. Germ. et Helv. ed. 1. 795 (1837). This *section* was subsequently used in the same sense by authors such as *Benth.* and *Hooker* [Gen. Pl. iii. 1160 (1883)], *Hackel* [Engl. Pflzfam. ii. 2. 56 (1887) et True Grasses, 123 (1896)], *Aschers.* and *Graebner* [Syn. Mitteleurop. Flor. ii. 243 (1899)], *Hitchcock* [Man. Grass. Un. States, 297 (1935)], and as a *subgenus* by *Rouy* [Fl. France, XIV, 126 (1913)].

Jessen, in Deutsch. Gräser, 214 (1863) put forward the name *Avenastrum* as a genus and included under it species such as (1) *Avena flavescens* L., (2) *Avena elatior* L., (3) *Aira caryophyllea* L. and (4) *Aira praecox* L. He thus not only raised *Koch's* sectional name

to generic rank, but modified its sense appreciably by including in it the heterogenous elements quoted above. The name and genus *Avenastrum* Jessen is superfluous since *Jessen* had included under it the older valid names and genera *Trisetum* Pers. (1805) [for (1) above] and *Arrhenatherum* Beauv. (1812) [for (2) above] and for this reason must be rejected as a "*nomen illegitimum.*"

Beck [Fl. Nieder.-Öst. 1. 72, in Ann. Nat. Hofmuseum. Wien V. 560–561 (1890)] recognised the genus *Avenastrum* Jess. but restricted its use and conceived it generically in the sense that *Koch* used it sectionally, i.e. differing only from *Koch's* conception *in rank.* The genus is used in the same restricted sense by *Stapf* [Dyer, Fl. Cap. VII, 472 (1899)] where strictly speaking the genus is *Avenastrum* Jess. pro parte.

Apparently *Beck* did not consider the genus *Heuffelia* Schur. [Enum. Pl. Transs. 760 (1866)] under which *Avena* sect. *Avenastrum* Koch [Syn. ed. 2. 918 (1844)] is cited as a synonym. *Avena pratensis* L. was included in this genus as well as in *Helictotrichon* Besser and on this account *Heuffelia* Schur. is congeneric with the older genus i.e. *Helictotrichon* Besser.

It may be pointed out that the name *Helictotrichon* Bess. is not an orthographic variant of *Helicotrichum* Nees (1818) as the former was derived from the adjective *helictos,* whereas the latter was derived from the noun *helix* and on this account both genera have the right to stand independently.

Furthermore the name *Helicotrichum* Bess. has been taken up in the Index. Kew. from Reichenb. Fl. Germ. Excurs. 1406. no. 352 (1832) where it is considered a synonym of *Avena planiculmis* Schrad. *Benth.* and *Hook. f.* [Gen. Pl. III. ii. 1160 (1883)] and *Hackel* [Engl. Pflzfam. II. ii. 56 (1887)] quote it as a synonym under *Avena* sect. *Avenastrum* Koch. It is probably only a misprint for *Helictotrichon* Bess.

III.—DESCRIPTION OF THE GENUS.

Helictotrichon Bess. ex Schult. Mant. Syst. Veg. ii. Addit. I. 526 (326 errore) (1827).

Spikelets narrowly-oblong to oblong or elliptic-oblong, laterally compressed, usually erect or suberect, of medium size (8–15 mm. long, rarely smaller or larger), in nearly always erect often stiff panicles, rarely nodding. *Rhachilla* disarticulating above the glumes and between the valves, produced into a short bristle beyond the uppermost floret or ending with a rudimentary lemma; rhachilla-internodes glabrous, or short- or long-hairy, 1·5–4 mm. long. *Florets* 2–6, ⚥, or the uppermost more or less reduced. *Glumes* 2, persistent, hyaline or subhyaline, subequal or unequal, acute or acuminate, more or less distinctly keeled; the lower 1–3-nerved; the upper 3–7-nerved (3-nerved in the South African species). *Lemmas* usually distinctly exserted from the glumes, rarely subincluded, more or less herbaceous with scarious or hyaline tips, often rather firm, at length becoming indurated, acute or acuminate, bifid (rarely 4-fid), with or without bristles from the lobes, 5–11-nerved, awned; awn dorsal, from the middle or slightly above the middle of the lemma, kneed and twisted (at times spuriously) below the bend; callus short or elongate, villous. *Paleas* shorter than the lemmas, 2-keeled, ciliate. *Lodicules* 2, rather large, hyaline. *Stamens* 3. *Ovary* hairy from above the middle or at the apex only; styles distinct, short; stigmas usually laterally exserted, plumose. *Caryopsis* oblong, slightly laterally compressed, usually grooved in front, hairy at the apex, pallid, soft, embraced by the hardened lemma and palea; hilum linear, up to half the length of the grain; embryo small. *Caespitose* perennials; leaf blades linear, usually narrow, flat or convolute, sometimes setaceous; ligules hyaline or scarious; panicle narrow, more rarely diffuse, erect or nodding.

Species about 65; mainly natives of the temperate regions of the northern hemisphere, but also occurring on the mountains of Java, extending through the high mountain regions of tropical Africa to South Africa.

IV.—KEY TO THE SPECIES.

A.—Rhachilla-internodes from 2·5–4 mm. long, densely bearded for the greater part of their length:

B.—Inflorescence very compact, composed of numerous spikelets:

C.—Lemma with prominently raised nerves, finely granular between but not on the nerves; callus 1–1¼ mm. long; glumes narrowly lanceolate, prominently nerved and hyaline.. 1. *quinquesetum.*

CC.—Lemma not prominently nerved, often scabrous at the insertion of the awn but smooth dorsally below it, and minutely scaberulous towards the margins, distinctly so towards the apex of the lobes; callus 1¼–2 mm. long; glumes broadly lanceolate, not very prominently nerved, not sub-hyaline 2. *longum.*

BB.—Inflorescence short, lax to very lax, composed only of relatively few spikelets:

D.—Plants about 30 cm. high. Lemma about 1·0 cm. long (excluding the bristles), distinctly coarsely granular on the back in the dorsal middle third, granules also present on the nerves.. 3. *namaquense.*

DD.—Plants about 80 cm. high. Lemma slender, about 1·5 cm. long (excluding the bristles), smooth dorsally, not prominently nerved, very minutely scaberulous near the margin in the upper half, slightly scaberulous along the nerves.. 4. *barbatum.*

AA.—Rachilla-internodes 1·5–2·5 mm. long:

E.—Rachilla-internodes glabrous, smooth, acute, hardly dilated at the apex; lobes of lemma (above insertion of the awn) about 10 mm. long or slightly longer.................. 5. *leoninum.*

EE.—Rhachilla-internodes bearded and dilated near the apex; lobes of lemmas up to 8 mm. long, but usually much shorter:

F.—Lemmas scabrid or scaberulous:

G.—Florets scarcely exserted beyond the glumes; glumes broadly lanceolate; outer surface of lemmas minutely scaberulous all over.................. 6. *Galpinii.*

GG.—Florets exserted well beyond the glumes; glumes lanceolate; lemmas scabrid mainly at the insertion of the awn:

H.—Lemmas about 10 mm. long; rhachilla-internodes 2 mm. long.................................. 7. *capense.*

HH.—Lemmas about 7 mm. long; rhachilla-internodes about 1·5 mm. long.......................... 8. *hirtulum.*

FF.—Lemmas glabrous on the back below the point of insertion of the awn:

I.—Lemmas about 7 mm. long; column of awn with 1–3 twists.. 9. *natalense.*

II.—Lemmas usually 10 mm. long or somewhat longer; column of awn with more than 3 twists:

K.—Leaves many from the base of the culms, setaceous and up to 40 cm. long; spikelets usually gaping; rhachilla-internodes long-hairy and usually evident.......................... 10. *longifolium*.

KK.—Leaves not setaceous, often convolute. Rhachilla-internodes usually not readily evident:

L.—Glumes broadly lanceolate; lemmas lanceolate in profile; lobes (above insertion of awn) 3 5 mm. long; anthers 1 mm. long, rarely 2 mm. in some florets; cleistogamous?.......................... 11. *turgidulum*.

LL.—Glumes lanceolate, acuminate; lemmas narrowly lanceolate, slender in profile; lobes (above insertion of awn) 6–8 mm. long; anthers 1·5 2 mm. long........ 12. *Dodii*.

V.—ENUMERATION OF THE SPECIES.

1. **H. quinquesetum** (Steudel) Schweickerdt, comb. nov.

Syn.: *Avena quinqueseta* Steudel, in Flora, 1829, 485; Kunth., Enum. I, 305 (1833).
Trisetum Steudelii Nees, in Linnaea, VII, 308 (1832); Fl. Afr. Austr., 349 (1841); Steudel, Syn. Pl. Glum, i, 228 (1854); Dur. and Schinz, Consp. Fl. Afr., V, 840 (1894).
Avenastrum quinquesetum Stapf, in Dyer, Fl. Cap., VII, 474 (1899).

Culms 50 75 cm. high, glabrous, 2 4-noded, sheathed to 5–10 cm. below the panicle. *Leaves* 4–6, arising from near the base, 2 higher up; lowest sheaths somewhat compressed, firm, minutely puberulous, strongly nerved, the upper more terete and glabrous; ligule truncate, irregularly laciniate, up to 3 mm. long; blades linear, with callous tips, flat or conduplicate, up to 25 cm. long and 4 mm. wide, the upper usually much shorter, rigid, strongly and closely nerved, glabrous. *Panicle* contracted, rather dense and almost spikelike, narrow, 12–18 cm. long, straight or subflexuous; branches fascicled, very unequal, branched from near the base, adpressed to the rhachis; the longest up to 5 cm. long. *Spikelets* 12 18 mm. long, very loosely 2-sub-3-flowered. *Glumes* narrow-lanceolate, acuminate, prominently nerved, glabrous, scarious along the margin and towards the apex; the lower 8–11 mm. long and about 1½ mm. broad: the upper 10 13 mm. long and 1½–3 mm. broad. *Rhachilla-internodes* 3½–4½ mm. long, acute, slightly broadened towards their apex, slender, hairy almost to the base with white spreading hairs up to 4 mm. long. *Lemmas* shortly exserted, linear-lanceolate, the lowest (including callus and lobes, but excluding the awn) up to 18 mm. long, pallid, rather firm, with prominently raised nerves, glabrous below the insertion of awn, finely granular between the nerves up to the base of the valve; lobes 10–12 mm. long, finely scaberulous and scarious towards the apex; each lobe usually terminating in 2 bristles of unequal length (termination of veins). *Callus* subulate, up to 1¼ mm. long, densely bearded with hairs about 1½ mm. long; awn inserted ± 7 mm. from the base of the valve; column 8–10 mm. long: bristle up to 18 mm. long. *Palea* about 9 mm. long; keels prominently ciliolate. *Anthers* 2½ mm. long. *Ovary* pubescent for the greater part of its length.

CAPE PROVINCE.—Table Mountain, near Capetown, *Ecklon*, 929! without precise locality, *Harvey*, 295!

This species appears to be very rare; it is represented in most herbaria only by duplicates of the type gathering (*Ecklon*, 929). The type specimen of *Avena quinqueseta* Steudel is deposited in the *Fielding Herbarium, Oxford.*

2. H. longum (Stapf) Schweickerdt comb. nov.

Syn.: *Trisetum antarcticum* Nees, Fl. Afr. Austr. 346 (1841) pro parte, exclud. syn. pro parte; in Linnaea, XX, 254 (1847), not in Linnaea, VII, 307 (1832).
Trisetum longifolium Nees, Fl. Afr. Austr., 347 (1841), pro parte.
Avena longa Stapf, in Kew Bull., 1897, 292.
Avenastrum longum Stapf, in Dyer, Fl. Cap. VII, 473 (1899).
Avenastrum longum Stapf, var. *grande* Stapf, l.c.

Culms 60–110 cm. high, glabrous, about 3-noded, sheathed almost up to base of inflorescence. *Leaves* 3–6 from near the base, and usually 3 higher up along the culm; sheaths rather loose; the lower persistent, usually glabrous, strongly striate; the upper glabrous or more or less densely pubescent with reflexed short hairs; ligules conspicuous, 3–5 mm. long, truncate, usually somewhat torn; blades linear to linear-lanceolate, tapering to a fine point, 15–30 cm. long, very variable in width, 2·5–10 mm. wide, flat or involute, flaccid, glabrous, smooth or rough above, markedly striate. *Panicle* contracted or somewhat interrupted, linear, linear-oblong or oblong, 20–30 cm. long, nodding and flexuous, or fairly straight and robust; branches fascicled, very unequal; the longest up to over 5 cm. long, branched from near the base or simple, filiform, flexuous, scaberulous. *Spikelets* up to 30 mm. long (including the bristles of the lemmas), usually about 20 mm. long, 4–5 flowered. *Glumes* lanceolate, acuminate; the lower 6·5–9 mm. long, 1-sub 3-nerved; the upper 9–12 mm. long, 3-nerved. *Rhachilla-internodes* 2·5–3 mm. long, bearded throughout with hairs up to 3 mm. long. *Lemmas* rather firm, pallid, sometimes purplish, up to 18 mm. long (including the bristles but excluding the awn), not conspicuously nerved, minutely granular on the back below the insertion of the awn, sometimes scabrid along the margins; lobes beyond the insertion of the awn about 10 mm. long, scabrid. *Callus* 1·25 2 mm. long, long-bearded. *Awn* inserted about 8 mm. distant from the base of the lemma; column 6–9 mm. long; bristle 15 mm. or somewhat longer. *Palea* about 7 mm. long, inconspicuously ciliolate. *Anthers* 2·5–3 mm. long. *Ovary* puberulous in upper half.

The type specimen (*Zeyher*, 1807) is deposited in the *Kew Herbarium.*

Cape Peninsula.—Cap. b. Spei, *Bergius*, 228! In humidis planib. Capens. atque dunarum, Oct., *Zeyher*, 1807, 1807b! In arenosis ad litus maris pone van Kampsbay, Oct., *Zeyher* (38?) in *Herb. Bolus*, 21723 et in *Herb. Mus. Austro-Afr.*, 19430. Kenilworth Race Course, *L. Bolus*, 15054! University grounds, Rondebosch, Nov., *Levyns*, 3674. Ottery Rd., sandy flats, *Adamson*, s.n! Klein Slangkop, about 500 ft., *Wolley-Dod*, 3004. Camp Ground, *Wolley-Dod*, 3473. Slopes beyond Miller's Point, Sept., *Wolley-Dod*, 3003! Table Mountain, *Rogers*, 30434! Upper northern slopes of Lion's Head, *Wolley-Dod*, 3571! Orange Kloof below farm, *Wolley-Dod*, 3128! In grassy rocky places above Camps Bay, *McOwan*, 1793! Stellenbosch Div., near Firgrove, Oct. *C. Sandwith*, 147!

Among the South African representatives, this species appears to be the most robust with regard to inflorescence; in width of leaf and indumentum of the vegetative parts it appears to be somewhat variable and for this reason Stapf's var. *grande* is considered merely an extreme form which does not deserve varietal rank.

3. H. namaquense Schweicherdt nom. nov.

Syn.: *Trisetum Dregeanum* Steud., Syn. Pl. Geum., 227 (1854), nomen illegit.; Dur. and Schinz, Consp. Fl. Afr., V, 838 (1894).
Trisetum barbatum Nees *β minus* Nees, Fl. Afr. Austr., 345 (1841).
Avenastrum dregeanum (Steud.) Stapf, in Dyer, Fl. Cap., VII, 473 (1899).

A densely caespitose perennial. *Culms* about 30 cm. long, slightly bulbous at the very base, glabrous, striate, slender, 1-noded; node much below the middle; sterile leafy shoots many at the base of the culms. *Leaves* about 4 from near the base of the culm, one

or two sheathing it for the greater part of its length; sheaths fairly tight, glabrous; the lower persistent and sub-membranous; the upper striate, somewhat contorted; ligule truncate, 1–1½ mm. long; blades linear with callous tips; the lower up to 10 cm. long, usually shorter and 2 mm. or less wide, flat or convolute, rigid, subglaucous, striate, hairy above, scaberulous beneath. *Panicle* suberect or nodding, 6–10 cm. long, very loose, secund; branches paired, 1–3-spiculate, very unequal, somewhat spreading, filiform, scabrid; the lowest up to 2½ cm. long. *Spikelets* 10–15 mm. long, very loosely 3–4-flowered. *Glumes* unequal, submembranous, lanceolate, acuminate; the lower 8–9 mm. long and 2 mm. broad, 1-nerved; the upper 12 mm. long, 3–3½ mm. wide, 3-4-nerved, scabrid on the main nerve. *Rhachilla-internodes* 2½–3 mm. long, bearded in the upper two thirds with hairs 4-5 mm. long. *Lemmas* long-exserted, oblong-lanceolate; the lowest ± 14 mm. long (including the setaceous lobes but excluding the awn), glabrous, pallid, firmly coriaceous, coarsely granular-scabrid on the back just below the insertion of the awn, smooth and glabrous towards the base; lobes strongly nerved, submembranous, ending in scaberulous bristles. *Callus* 1¼ mm. long, curved, bearded with hairs 2·5 mm. long. *Awn* inserted ± 5½ mm. from the base of the valve; column ± 8 mm. long; bristle ± 12 mm. long. *Palea* about 8 mm. long, linear-lanceolate, conspicuously ciliolate. *Anthers* up to 3½ mm. long. *Ovary* hairy above the middle.

CAPE PROVINCE: Namaqualand, Kamiesbergen, steinige Berggegend bei Ezelsfontein, 3–4,000 ft., Nov., *Drège*, 2526!

The type specimen is deposited in the *Berlin Herbarium.*

Apparently a very rare species since only this gathering is known from the European herbaria. It has apparently not been gathered again either on the Kamiesbergen or in any other locality since Drège's time.

Stapf [in Fl. Cap. VII, 474 (1899)], under *Avenastrum dregeanum* cites *Drège* 2625. This number is probably an error for 2526 which is the number of the type specimen of *Trisetum barbatum* Nees var. *β minus* in Herb. Nees.

Steudel [Syn. Pl. Glum. 227 (1854)] created the name *Trisetum Dregeanum*, with the intention that it should replace the name *Trisetum barbatum* Nees [Fl. Afr. Austr. 345 (1841)] which he considered to be a later homonym of *T. barbatum* Steud. [Nom. ed. II. ii. 713 (1841)]. The latter, however, is a *nomen tantum* whereas *Nees'* species bearing the same name was validly published. Consequently *T. barbatum* Nees may stand whereas *Trisetum Dregeanum* Steud. is a superfluous name and as such must be rejected.

In *Steudel's* description of *T. Dregeanum* the culms are described as being "pedali" i.e. about 30 cm. high. This obviously does not apply to *T. barbatum* Nees *var. α*, which is a much taller plant and of which I have seen the type in *Herb. Nees.* It applies moreover to *T. barbatum* Nees var. *β minus* Nees as I have seen both the type of the latter and the specimen of *T. Dregeanum* from the *Steudel Herbarium* (Paris) and have found them to agree in every respect, in fact they are part of the same gathering by *Drège.* It should be pointed out, however, that both these sheets represent a species distinct from *T. barbatum* Nees *var. α.*

As a result of misidentification *Steudel* thus inadvertently applied a new name to the wrong plant. Later authors, e.g. *Dur.* and *Schinz*, and *Stapf* in following *Steudel* have consequently also misapplied the epithet "*dregeanum.*" It thus cannot be accepted to designate Nees' *T. barbatum* var. *β minus.* As this variety should be given specific rank, I have named it *H. namaquense.*

4. **H. barbatum** (Nees) Schweickerdt comb. nov.

Syn.: *Trisetum barbatum* Nees, var. — Nees, Fl. Afr. Austr., 345 (1841), non Steudel.

Densely caespitose. *Culms* up to 75 cm. high, with numerous sterile leafy shoots from the base, glabrous or very minutely scaberulous, slender, striate, about 2-noded; nodes

somewhat exserted. *Leaves* few from near the base of the stem, two to three upwards along the culm; lowermost sheaths submembranous, pale, striate, persistent, glabrous, finally splitting into fine fibres; upper sheaths somewhat striate, glabrous or scaberulous towards the ligule, fairly lax and somewhat contorted; ligule about 3 mm. long, irregularly fimbriate; blades narrowly linear, up to 17 cm. long, usually much shorter, 1½–3 mm. wide, striate, scaberulous. *Panicle* very lax, few-flowered, about 8–10 cm. long, somewhat branched; branches filiform, unequal; the lowest up to 2½ cm. long, scaberulous, each bearing 1–2 spikelets. *Spikelets* very laxly 3–4-flowered, 14–17 mm. long. *Glumes* lanceolate; lower 8–9 mm. long, submembranous, glabrous but scaberulous along the nerves, acute; upper 14 mm. long, 3-nerved, submembranous, acute, glabrous, somewhat scaberulous along the nerves. *Rhachilla-internodes* 3–3·5 mm. long, bearded in the upper two thirds with white hairs 5–6 mm. long. *Lemmas* 16 mm. long (including the bristly lobes, but excluding the awn), smooth on the back below the point of insertion of the awn, minutely but distinctly scaberulous along the nerves especially in region of the hyaline lobes beyond the insertion of the awn; lobes about 10 mm. long, each ending in a fine bristle. *Callus* about 1 mm. long, bearded with white hairs about 2 mm. long. *Awn* inserted about 6–7 mm. from base of valve; column of awn ± 10 mm. long; bristles 15–17 mm. long. *Palea* 8 mm. long, not very conspicuously ciliolate. *Anthers* linear, 2–2½ mm. long. *Ovary* pubescent in upper half.

Cape Province.—Namaqualand, on the Kamiesbergen, Nov., *Drège*, 2572b! in *Herb. Nees.* et in *Herb. Mus. Austr.-Afric.*

The type specimen is deposited in the *Berlin Herbarium.*

Nees [Fl. Afr. Austr. 345 (1841)] cites as the type of *Trisetum barbatum* var. a gathering by *Ecklon.* This is probably an error as the type in *Herb. Nees*, viz. the specimen cited is a gathering by *Drège.*

Trisetum barbatum Steud. [Nom. ed. II. ii. 713 (1841)] is a *nomen tantum* and therefore *Trisetum barbatum* Nees, which was validly published, can stand and takes precedence over the former.

Steudel [*Syn. Pl. Glum.* 227 (1854)] renamed the above plant *Trisetum Dregeanum*, but in reality his description applies to *Trisetum barbatum* Nees var. *β minus* Nees which is a species distinct from *T. barbatum* Nees var. *a.* *T. Dregeanum* Steud. therefore must be sunk in synonomy under the above species. For further information the reader is referred to the remarks in this paper under *H. namaquense.*

H. barbatum (Nees) Schweickerdt is apparently a rare species, since in herbaria it is only represented by *Drège's* gathering. No other collector seems to have found this species since *Drège's* time.

5. **H. leoninum** (Steudel) Schweickerdt comb. nov.

Syn.: *Avena leonina* Steud., in Flora, 1829, 484; Kunth, Rév. Gram. ii, 521, t. 175 (1831); Kunth, Enum., i, 303 (1833); Trin., in Mem. Acad. Petersb., Ser. VI, Sc. Nat., IV, ii, 29 (1836).
Danthonia leonina Steud. ex Kunth, Enum., i, 303 (1833), in syn.
Trisetum antarcticum Nees, in Linnaea, VII, 307 (1832), pro parte, non Trin.
Avenastrum antarcticum Stapf, in Dyer, Fl. Cap., VII, 476 (1899), pro parte.

Densely caespitose with numerous barren shoots. *Culms* up to 50 cm. high, usually somewhat shorter, glabrous, 2–3-noded, internodes included or exserted. *Leaves* mainly from near the base; sheaths terete, fairly tight, glabrous or with spreading fine hairs, strongly striate; lowermost persistent and eventually splitting into fibres; upper somewhat compressed, not slipping off the culms; ligule about 1½ to 2 mm. long, irregularly dentate; blades linear, flat, tapering to a callous point, up to 10 cm. long, but usually much shorter, up to 3 mm. wide, glabrous or scantily pubescent, markedly nerved. *Panicle*

contracted, linear, erect, stiff or somewhat flexuous. up to 10 cm. long, often much shorter; lower branches in pairs, unequal in length; the longer up to 4 cm. long and 2–3-spiculate, scaberulous. *Spikelets* 3–5-flowered, 12–14 mm. long, greenish. *Glumes* lanceolate, acuminate, unequal, glabrous; margins and apex scarious; the lower 5½–7 mm. long, narrow; the upper 7½–9 mm. long. *Rhachilla-internodes* 1½–2 mm. long, *gradually tapering to an acute point, never widened at the apex*, usually glabrous but very rarely with a few scattered hairs near the apex. *Lemmas* 12–14 mm. long (including callus and lobes, but excluding the awn), coriaceous, dorsally scaberulous, decreasing in scabrosity towards the lobes above the insertion of the awn; lobes 9–10 mm. long, with scarious margins. *Awn* inserted about 5½ mm. from the base of lemma; column 7–9 mm. long; bristle ± 13 mm. long. *Callus* 1 mm. long, clothed with short hairs. *Palea* conspicuously ciliolate. *Anthers* 2 mm. long. *Ovary* pubescent in the upper half.

CAPE PROVINCE.—Cape Peninsula: Table Mountain, *Pappe*, pro parte! Lion's Head Mountain, *Ecklon*, 928! and *Zeyher*, 101! Signal Hill, nr. Lion Battery, *Wolley-Dod*, 2747! Field below Prince of Wales Blockhouse, *Wolley-Dod*, 1474! 1477! Orange Kloof, below Constantia Nek, Oct., *Bolus*, 14667! Near Maitland Stn., Oct., *Wolley-Dod*, 3167! Alongside Pipe Track, Orange Kloof, Oct., *F. Bolus*, s.n.! Under Pine Trees, Signal Hill, Aug., *Levyns*, s.n.!

On account of the glabrous acute rhachilla-internodes this well-defined species taxonomically occupies a singular position among the South African representatives of the genus.

6. **H. Galpinii** Schweickerdt. spec. nov.; affine *H. turgidulo* (Stapf) Schweickerdt, sed lemmatibus omnino scaberulis distinguitur.

Syn.: Phillips, in Ann. A. Afr. Mus., XVI, i, 343 (1917), sub. *Avenastrum turgidulum* Stapf.

Gramen perenne, dense caespitosum. *Culmi* erecti, usque ad 60 cm. alti, graciles; 2–3-nodes, paniculis et nodis superioribus exsertis, glabri laevesque, striati, ad basin ramis foliatis. *Vaginae* pubescentes, infimae striatae, demum in fibras fissae, superiores striatae, vix glabrae. *Ligula* fere 1·5 mm. longa. *Laminae* erectae, fere rigidae, lineares, 12–16 mm. longae, nonnunquam breviores, in acumen callosum productae, planae vel leviter involutae, 2·5–3 mm. latae, subtus pilis fere dense munitae, supra sparse pubescentes et valde striatae. *Panicula* leviter contracta, 10–16 cm. longa, angusta; rhachis glabra laevisque, apicem versus nonnunquam scaberula; rami fasciculati, inaequales, usque ad 3·5 cm. longi, erecti, scaberuli, 2–4-spiculati. *Spiculae* 3–4-florae, floribus vix exsertis, 8–10 mm. longae, erectae. *Glumae* subaequales, tota facie scaberulae (vel minute pubescentes), valde striatae, subhylinae, purpureo-pictae; inferior 9 mm. longa et 2 mm. lata, 3-nervis, late lanceolata; superior 10·5 mm. longa et 3 mm. lata, 3-nervis, late lanceolata. *Internodia* rhachillae fere 1·25 mm. longa, apicem versus pilis 3 mm. longis valde barbata. *Lemmata* usque ad 8·5 mm. longa, 5-nervia; arista 4 mm. basin lemmatis inserta, tota facie minute scaberula; lobi 4–4·5 mm. longi, scabri, in setas scabras producti. *Callus* pilis 2 mm. longis barbatus. *Aristae* columna 5 mm. longa. *Paleae* dorso tertiis partibus superioribus scaberulae, carinis ciliolatis. *Antherae* 2 mm. longae. *Ovarium* 1·25 mm. longum, apicem versus dense villosum.

CAPE PROVINCE.—Barkly East distr., at an altitude of 9,700 feet (2,900 metres) on Ben McDhui (Wittebergen), March, *Galpin*, 6902, pro parte (type deposited in *Nat. Herb. Pretoria* and in the *Kew Herbarium*).

A species which appears to be well-defined by the subincluded florets, the lemmas of which are minutely scaberulous on the outer surface.

Galpin's gathering 6902 is a mixture of the above species and typical *H. turgidulum* (Stapf) Schweickerdt; the latter may, however, be readily distinguished by the glabrous lemmas.

7. **H. capense** Schweickerdt spec. nov.

Syn.: *Ave. ·strum antarcicum* Stapf, in Dyer, Fl. Cap., VII, 476 (1899), pro parte.
affine *H. hirtulo* (Steud.) Schweickerdt, sed paniculis laxioribus, spiculis majoribus, lemmate minus scabrido, rhachillae internodio longe brabato differt.

Gramen perenne, dense caespitosum. *Culmi* erecti, usque ad 100 cm. alti, glabri, circiter 3-nodes, nodis exsertis et basin versus ramis foliatis. *Vaginae* striatae, glabrae vel minute puberulae, inferiores demum in fibras fissae, superiores fere laxae. *Ligula* circiter 0·75 mm. longa. *Laminae* filiformis vel anguste lineares, nonnunquam involutae, usque ad 25 cm. longae, subtus glabrae vel minute scaberulae, supra pilis sparse praeditae. *Panicula* erecta vel leviter flexuosa, usque ad 20 cm. longa; rhachis glabra; rami inaequales, fasciculati, filiformis, leviter flexuosi, usque ad 4 cm. longi. *Spiculae* circiter 15 mm. longae, 4–5-florae. *Glumae* inaequales, lanceolatae, acuminatae, subhyalinae, valde nervatae; inferior fere 5·5 mm. longa; superior fere 7 9 mm. longa, dorso apicem versus minute scaberula. *Lemmata* usque ad 12 mm. longa, lineari-lanceolata, pallida, firma, dorso valde vel leviter scabra; lobi fere 6 mm. longi, minute scaberuli, in setis scabris producti. *Arista* fere 5 mm. basin lemmatis inserta; columna 4 5-mm. longa. *Internodia* rhachillae 2 mm. longa, apicem versus dilatata, pilis 3 mm. longis dense barbata. *Paleae* 5·5 mm. longae, carinis ciliolatis. *Antherae* 2 mm. longae. *Ovarium* apicem versus villosum.

The type specimens are deposited in the *Kew Herbarium* and in *Nat. Herb. Pretoria.*

Cape Province.—Cape Peninsula: Table Mountain, *Pappe*, pro parte!. Kalk Bay Mountain, *Bolus*, 14652!. Riversdale distr.: Zoetmelksrivier, *Burchell*, 6694!. East London distr.: East London, May, *Rattray*, 720!. Gonubie, Sept., *Dyer*, 2053!. Komgha distr.: near Komgha, *Flanagan*, 935 (type)!. Kentani distr.: Among tall valley grasses, *Pegler*, 2057!. King Williamstown distr.: Nahoon River, near Kei Road Station, Nov., *Galpin*, 8244!. Near Cemetery, Nov., *Sim*, 2803!.

Natal Province.—Durban: Clairmont, *Schlechter*, 3089!.

The plants placed under this species bear a close resemblance to *H. hirtulum* (Steud.) Schweickerdt and are often confused with that species. *H. capense* has, however, larger spikelets and the panicle tends to be somewhat more open than that of the allied species.

8. **H. hirtulum** (Steud.) Schweickerdt comb. nov.

Syn.: ?*Avena hirta* Schrad., in Goett. Gel. Anz., iii, 2075 (1821); Schult. Mant, pt. ii, 374 (1824).
Avena symphicarpa Trin. ex Steud., Nomencl., ed. ii, i, 173 (1840), nomen tantum.
Avenastrum antarcticum Stapf, in Dyer, Fl. Cap., VII, 476 (1899), pro parre
Trisetum hirtum Nees, Fl. Afr. Austr., 350 (1841), non Trin.; Linnaea, XX, 254 (1847).
Trisetum hirtulum Steud., Syn. Pl. Glum, i, 228 (1854); Dur. and Schinz, Consp. Fl. Afr., V, 838 (1894).

A weak perennial with several barren shoots between the culms. *Culms* up to 100 cm. long but usually very much shorter, terete, glabrous, 2–3-noded; upper internodes exserted. *Leaves* few near the base, soon dying off, higher up somewhat distant: sheaths persistent; the lower soon breaking up into fibres, glabrous; the upper pubescent with reflexed hairs or glabrous, fairly light, terete; ligule about 1 mm. long, irregularly dentate; blades narrowly linear, tapering to an acute point, often involute, up to 25 cm. long, subrigid or flaccid, glabrous or hairy, finely nerved, smooth or scaberulous. *Panicle* contracted, linear, erect

or somewhat flexuous, 10–20 cm. long, branched; lower branches usually in pairs, of unequal length; the longer up to 5 or 6 cm. long. *Spikelets* up to 10 cm. long, 3–5-flowered. *Glumes* unequal, acute; the lower narrowly lanceolate, glabrous, almost hyaline, 1-nerved, 3½–6 mm. long; the upper broadly lanceolate, narrowed at the base, glabrous, hyaline towards the margins and apex, 3-nerved, up to 7 mm. long. *Rhachilla-internodes* 1½–2 mm. long, widened and flattened towards the apex, acute, clothed in the upper part with hairs 1·5–2 mm. long, glabrous in the lower part. *Lemmas* exserted beyond the glumes, lanceolate, acuminate, dorsally scabrous especially below the point of insertion of the awn; the lower 7–8½ mm. long; the upper somewhat shorter; lobes hyaline, setaceous, glabrous. *Awn* inserted 3½ 4½ mm. from the base of the valve; column 5–7 mm. long. *Callus* of lemma very short, inconspicuous, bearded with hairs about 0·5 mm. long. *Palae* hyaline, conspicuously and markedly ciliolate along the keels, about 6–6½ mm. long. *Anthers* 1½–2 mm. long. *Ovary* pubescent in upper half.

The type specimen indicated below is deposited in the *Berlin Herbarium*.

CAPE PROVINCE.—Cape Peninsula: Rondebosch, University Grounds, *Levyns*, 3560!, 3669!. Caledon distr.: Zwartberg, near the Hot Springs, 1,000–2,000 ft., *Ecklon* and *Zeyher*, 4553!. Albany distr.: Near Grahamstown, *McOwan*, 1302!. Kalksteinrücken auf der Höhe des linken Buschmann—flusses Ufer, *Zeyher*, 143!. Grahamstown, Apr., *Daly*, 150, 152.! Botha's Hill, *Dyer*, 1480!. Bathurst distr.: Trappes Valley, Dec., *Daly*, 678.! Alexandria distr.: Urwälder bei Olifantshoek am Bosjesman-rivier, *Ecklon*, s.n. (type)! Queenstown distr.: Fincham's Nek, 4,000 ft., *Galpin*, 3281!.

This species is allied to *H. capense*, but may be distinguished from the latter in being a weaker plant with smaller spikelets and having an inflorescence which usually is more contracted and spike-like than that of the allied species.

[Whether *Avena hirta* Schrad. l.c. is conspecific must remain an open question until the type specimen has been located. It is believed to be at Leningrad but so far has not been traced there.]

9. **H. natalense** Schweickerdt stat. nov.; affine *H. longifolio* (Nees) Schweickerdt, sed foliis latioribus, spiculis glumis lemmatibusque minoribus differt; affine *H. hirtulo* (Steud.) Schweickerdt, sed panicula laxiora, lemmatibus glabris distinguitur.

Syn.: *Avenastrum caffrum* Stapf, var. ? *natalensis* Stapf, in Dyer, Fl. Cap., VII, 477 (1899); Medley Wood, Natal Plants, II, tab. 191 (1904).

Gramen perenne. *Culmi* erecti, usque ad 1 m. alti, 4-nodes, infra nodes minute puberuli, graciles, nodis et paniculis exsertis. *Foliorum* vaginae striatae, minute scaberulae, pilis sparsis munitae. *Ligulae* breves, circiter 0·5 mm. longae. *Laminae planae*, vix subflaccidae, usque ad 25 cm. longae et 4 mm. latae, perraro involutae, valde striatae, subtus scaberulae supra scaberulae et pilis sparsis munitae. *Panicula* 25 cm. longa, diffusa, laxa, rhachis scaberula, filiformis; rami fasciculati, valde inaequales, usque ad 3·5 cm. longi, simplices vel parce ramosi, filiformes, flexuosi, scaberuli vel hispiduli. *Spiculae* 7–8 mm. longae, laxe 3-sub-4-florae, floribus exsertis. *Glumae* acuminatae, valde inaequales; inferior 3 mm. longa, anguste lineari-lanceolata, 1-nervis, glabra, secus carinam scaberula; superior 6 mm. longa, lanceolate, valde 3-nervis, glabra, secus carinam scaberula. *Lemmata* exserta, usque ad 8 mm. longa, lineari-lanceolata, pallida, rigida, valde nervata, dorso infra aristam minute granulata; lobi 3 mm. longi vel breviores, in setas producti, secus nervos minute scaberuli. *Arista* 4·5 mm. basin lemmatis inserta, columna breve fere 3 mm. longa. *Callus* brevissimus, breviter barbatus. *Internodia* rhachillae fere 1·5 mm. longa, apicem versus pilis 3 mm. longis barbata. *Paleae* fere 4 mm. longae, carinis conspicue ciliolatis. *Antherae* 1·5–2 mm. longae. *Ovarium* apicem versus hirsutum.

The type specimens are deposited in the *Kew Herbarium* and in the *Natal Herbarium, Durban*.

NATAL PROVINCE.—Umvoti distr.: Rietvlei, 4,000–5,000 ft., *Buchanan*, 238 (type)! Zululand: Melmoth, Imfulazane, 4,500 ft., *Mogg*, 6089!

TRANSVAAL PROVINCE.—Belfast Distr.: Dullstroom, 6,500 ft., *Galpin*, 13008!

Although the lemmas in *Galpin* 13008 are on the whole more markedly nerved and slightly less conspicuously granulate than *Buchanan* 238, I have no hesitation in referring this sheet to *H. natalense* Schweickerdt.

Whereas all the other South African species have markedly twisted columns to the awn, this is not the case in the species in question, a character met with in the allied *Avenastrum lachnanthum* Pilger.

10. **H. longifolium** (Nees) Schweickerdt comb. nov.

Syn.: *Avena caffra* Stapf, in Kew Bull., 1897, 293.
Trisetum longifolium Nees, Fl. Afr. Austr., 348 (1841), pro parte; Steud., Syn. Pl. Glum., 228 (1854); Dur. and Schinz, Consp. Fl. Afr., V, 839 (1894).
Avenastrum caffrum Stapf, in Dyer, Fl. Cap., VII, 477 (1899); Phillips, in Ann. S. Afr. Mus., XVI, i, 343 (1917).

Densely caespitose with several sterile leafy shoots. *Culms* up to 90 cm. long, glabrous, 3–4-noded, sheathed to the base of the panicle. *Leaves* several from the base, 2–3-higher up along the culm; lower sheaths persistent, glabrous, markedly striate, breaking up into somewhat coarse fibres; upper not very tight, slightly contorted, glabrous, not markedly striate or only so towards the ligule; ligule oblong, up to 1½ mm. long; blades usually very narrow, subsetaceous, convolute; the lower up to 35 cm. long; the upper usually shorter, glabrous, strongly and closely few-nerved, with distinctly rough margins. *Panicle* usually lax and open, up to 20 cm. long; flexuous or slightly nodding and subflaccid; rhachis filiform, striate; branches fascicled, very unequal; the longest up to 5 cm. long, branched or simple, finely filiform, flexuous, scaberulous to finely hispidulous. *Spikelets* loosely 3–4-flowered, 8–10 mm. long. *Glumes* very thin, almost hyaline, strongly nerved; lower 5–6½ mm. long, very narrowly lanceolate, glabrous, acute, 1-nerved, scaberulous along the nerve; upper 8–9 mm. long, lanceolate, acuminate, 3-nerved, scaberulous along the main nerve and margins. *Rhachilla-internodes* usually prominently exposed, about 2 mm. long, bearded with hairs 3 4 mm. long. *Lemmas* exserted, linear-lanceolate; the lowest about 10 mm. long (including the lobes, but excluding the awn), glabrous, firm coriaceous, very minutely and evenly granular on the back below the insertion of the awn; lobes ± 5 mm. long, scarious, produced into short fine bristles. *Callus* ¾ mm. long, bearded with hairs 1½–2 mm. long. *Awn* inserted 5–5½ mm. from base of the lemma; column 5–8 mm. long; bristle ± 10 mm. long. *Palae* about 6 mm. long; keels ciliolate. *Anthers* 2–3 mm. long. *Ovary* pubescent in upper half.

CAPE PROVINCE.—Aliwal North distr.: Witte Bergen, on rocks, 7,500 ft., *Drège*, 8134! (Herb. Nees, lectotype!). Murraysburg distr.: At Snyder's Kraal, *Tyson*, 278!

ORANGE FREE STATE.—Senekal distr.: Wonderkop, frequent in moist places on upper and middle slopes of mountain, *Goossens*, 845! Doornkop, frequent on slopes of mountain, *Goossens*, 701!

BASUTOLAND.—Mafeteng distr.: Station Likhoele, *Dieterlen*, 400a! Leribe Plateau, *Dieterlen*, 967!

This species is liable to infection by a smut.

The species does not appear to occur in the south-western region of the Cape Province. *Stapf's* remark [Fl. Cap. VII, 477 (1899)] under *Avenastrum caffrum* is fully justified, as the sheets cited by *Nees* [Fl. Afr. Austr. 348 (1841)] under *Trisetum longifolium* are a mixture

of two distinct species. *Ecklon's* specimens from the dunes near Capetown belong to *Helictotrichon longum* (Stapf) Schweickerdt and in this paper are referred to that species, whereas *Drège* 8134 in Herb. Nees (Berlin) has been selected as the *lectotype* of *H. longifolium* (Nees) Schweickerdt. The specific epithet of the latter species takes precedence over that of *Avena caffra* Stapf.

11. **H. turgidulum** (Stapf) Schweickerdt comb. nov.

Syn.: *Trisetum antarcticum* Nees, Fl. Afr. Austr., 346 (1841), pro parte.
Trisetum imberbe Nees, Fl. Afr. Austr., 347 (1841); Steud., Syn. Pl. Glum., I, 228 (1854); Dur. and Schinz, Consp. Fl. Afr., V, 838 (1894).
Avena turgidula Stapf, in Kew Bull., 1897, 293.
Avenastrum turgidulum Stapf, in Dyer, Fl. Cap., VII, 474 (1899); Medley Wood, Natal Plants, II, tab. 190 (1904); Phillips, in Ann. S. Afr. Mus. XVI, i, 343 (1917).

Densely caespitose. *Culms* 30–100 cm. long, erect or geniculately ascending, glabrous, 2–3-noded; upper 2–3 internodes more or less exserted; uppermost often well exserted. *Leaves* few near the base, about 3 higher up along the culm; sheaths terete, not very tight, glabrous, puberulous or more rarely pubescent with short reflexed hairs, striate, often somewhat contorted; ligule truncate, up to 1·5 mm. long; blades linear, tapering to an acute point, up to 15 cm. long but often much shorter, up to 4 mm. broad, flat or involute, more or less rigid or subflaccid, subglaucous, glabrous, more rarely scantily hairy, scaberulous above. *Panicle* contracted, sometimes interrupted, erect or slightly nodding, up to 30 cm. long; branches fascicled; the longer up to 5 cm. long, branched or simple, with spikelets sub-erect or somewhat spreading, filiform, scabrid. *Spikelets* 10–12 mm. long, greenish, compactly 3–5-flowered. *Glumes* lanceolate, acuminate; the lower 5–7 mm. long, 1-nerved; the upper 7–9 mm. long, 3-nerved. *Rhachilla-internodes* 2 mm. long, bearded with hairs $\pm$ 3 mm. long. *Lemmas* exserted, oblong-lanceolate; the lowest 7–8 mm. long, coriaceous, glabrous and finely granular dorsally below the point of insertion of the awn; lobes scarious, 4–6 mm. long. *Callus* about $\frac{2}{3}$ mm. long, bearded with relatively short hairs about $1\frac{1}{2}$ mm. long. *Awn* inserted about 5 mm. from the base of the lemma; column 5–7 mm. long; bristle 10–12 mm. long. *Palea* not conspicuously ciliolate, 6 mm. long. *Anthers* $\frac{2}{3}$-1 mm. long, occasionally a floret with anthers up to 2 mm. long, always included and florets thus very probably cleistogamous. *Ovary* pubescent from the middle, hispidulous at the apex. *Caryopsis* $2\frac{1}{2}$ mm. long.

Cape Province.—Uitenhage distr.: In somewhat moist places on the fields near the Zwartkops River, *Ecklon* and *Zeyher*, 463! *Zeyher*, 4551! Bathurst distr.: Trappes Valley, Dec., *Daly*, 639!. Mt. Currie distr.: Kokstad, Nov., *Goossens*, 323!, 339!, 179!. Ingeli Mountain, March, *Tyson*, 1270!. Umtata distr.: Bazeia, Nov., *Baur*, 364!. Engcobo distr.: Nqumakwe River, Jan., *Flanagan*, 2817!. Between Engcobo and Nqumakwe River, Jan., *Bolus*, 10363!. Queenstown distr.: Katberg, Effingham, Dec., *Galpin*, 8398!. Queenstown, *Everett*, 38!, 4!. Shiloh, Febr., *Baur*, 779!. Reservoir east of Queenstown, Jan., *Hilner*, 311!. Rocky banks of the Klipplaat River, 3,500 ft., *Drège*!. Molteno distr.: Broughton, Dec., *Flanagan*. 1673!. Molteno, June, *Mogg*, 2766!. Wittebergen, on Ben McDhui, March, *Galpin*, 6902 partim!. Aliwal North distr.: In a depression at Leeuwenspruit, between Kraai River and the Wittebergen, *Drège*. 3918!. Without precise locality, *Drège*, 4250 (*Herb. Nees*)!.

Basutoland.—Leribe, 5,000–6,000 ft., *Dieterlen*, 400!, 753!. Febr!., *Phillips*, 6317!. Mafeteng, Thaba Chicha Mountain, March, *Dieterlen*, 1275!.

Natal Province.—Pietermaritzburg distr.: Near Maritzburg, Dec., *Medley-Wood* 7228!. Klip River distr.: Umsinga, base of Biggar's Berg, *Buchanan*, 100!. Umvoti distr.: Greytown, *Buchanan*, 172!. Rietvlei, *Buchanan*, 156!. Weenen distr.: Culvers

Dec., *Rogers*, 28309!. Estcourt distr.: Oct., *Mogg*, 3314!. Bergville distr.: Mount aux Sources, *Bayer* and *McClean*, 272!. Tintwa Mountain, Strydhoek, Jan., *Doidge*, in *Nat. Herb., Pretoria*, 20565!. Lions River distr.: Nottingham Road, Oct., *Galpin*, 10251!.

Orange Free State Province.—Ladybrand distr.: Pinekloof, *Goossens*, 1044! Ficksburg distr.: Riverhill Farm, Jan., *Potts*, in *Grey Un. Coll. Herb.*, 3689!, 3690!. Senekal distr.: Senekal, Dec., *Goossens*, 815!, 821!, 949!. Bethlehem distr.: Stony veld near Bethlehem, Oct., *Richardson*, s.n!. Kroonstad distr.: Experimental Farm, Febr., *Pont*, 36!. Fauresmith distr.: Fauresmith, *Henrici*, 2310!.

Transvaal Province.—Potchefstroom distr.: Potchefstroom, Oct., *Burt Davy*, 5591!. *Theron*, 6!. Wakkerstroom distr.: Vlakfontein, *Burtt Davy*, 4154!. Ermelo distr.: Nooitgedacht, Dec., *Henrici*, 1364!; *Burtt-Davy*, 9064!. Bethal distr.: Leslie, *Bell* in *Nat. Herb. Pretoria*, 20550!. Belfast distr.: Dullstroom, banks of Crocodile River, Dec., *Galpin*, 13009!. Pretoria distr.: Wonderboompoort, *Rehmann*, 4493!. Division of Plant Industry Grounds, Oct., *Stent* in *Nat. Herb., Pretoria*, 20525!. Benoni distr.: Benoni, plentiful near water, *Bradfield*, T. 258!. Johannesburg distr.: Wattles, near a marsh, Oct., *Moss*, 13586!. Johannesburg, Oct., *Rand*, 920!.

The type specimen, *Zeyher* 463, is deposited in the *Kew Herbarium*.

In this species the ovaries are often infected by a species of *Tilletia* which may so alter the character of the inflorescence, that specimens so affected appear at first sight to belong to a different species. Among modern gatherings, *Dieterlen* 753 l.c. represents such an infected and malformed plant.

Trisetum imberbe cornutum Nees l.c. is furthermore such an infected plant, and since the name of this "species" was based on a monstrosity, it is a "*nomen illegitimum*" and for that reason must be rejected. It is pointed out elsewhere in this paper that *Avena antarctica* Thunb. is a *nomen dubium* and for that reason is rejected. The only remaining specific ephithet available to designate this species is therefore that of "*turgidula*" derived from *Avena turgidula* Stapf l.c. and the type of this species is naturally also Stapf's plant, viz. *Zeyher* 463!.

12. **H. Dodii** (Stapf) Schweickerdt comb. nov.

Syn.: *Avenastrum Dodii* Stapf, in Dyer, Fl. Cap. VII, 475 (1899).

Perennial. *Culms* erect, slender, about 100 cm. high, glabrous, smooth, 3-4-noded, sheathed all along or nearly so, with 1-2 erect intravaginal branches from the lowest nodes. *Leaves* 3 or fewer from near the base, and 3–4 higher up, distant; sheaths not very tight; the upper rather loose, markedly striate, glabrous and smooth; ligule oblong, up to 4 mm. long; blades linear; the lower tapering from a long attenuate base to a fine point, 30 50 cm. long and 3-5 mm. wide, flat or with involute margins, fairly rigid, more or less glaucous, glabrous, smooth below, strongly striate and scabrid on the upper surface. *Panicle* contracted, 20–30 cm. long, narrow, dense or somewhat interrupted, slightly nodding; rhachis smooth; branches fascicled, unequal, divided from the base or nearly so; longest up to 5 cm., erect, scaberulous or smooth below. *Spikelets* about 12 mm. long, narrow, erect, 4–5-flowered. *Glumes* subequal, lanceolate, shortly aristulate, subhyaline; the lower 6–7 mm. long and 1-nerved; the upper 7–9 mm. long and 3-nerved. *Rhachilla-internodes* 2 mm. long, bearded upwards with hairs about 3-3½ mm. long. *Lemmas* distinctly exserted, lanceolate, 13–14 mm. long (including the lobes but excluding the awn), glabrous, light green, rather firm, finely granular on the back; lobes scarious, 7 mm. long, produced into fine long bristles. *Callus* about ⅔ mm. long, short, bearded with hairs about 1·25 mm. long. *Awn* inserted 5–6 mm. from the base of the lemma; column 5 7 mm. long; bristle 12–15 mm. long. *Palea* 5 mm. long, densely but not conspicuously ciliolate along the keels. *Anthers* 2 mm. long. *Ovary* pubescent in upper half.

The type specimen *Wolley-Dod* 2775 is deposited in the Kew Herbarium.

CAPE PROVINCE.—Without precise locality, *Lehmann* (in Herb. Kunth)! Cape distr.: Wet slopes near Oatlands Point, *Wolley-Dod*, 2775! By wet rocks, Hout Bay Fisheries. *Wolley-Dod*, 3170! Platklip, near Capetown, along contour path, Nov., *Andreae*, 83,! Rondebosch, University grounds, Nov., *Levyns*, 3672, 3565!

VI.—*AIRA ANTARCTICA* FORST. AND *AVENA ANTARCTICA* THUNB.

During the investigation regarding the identity of *Avena antarctica* Thunb. it became evident that a specimen of this species first described in Thunb. Prodr. Pl. Cap. 22 (1794) is no longer deposited in Thunberg's Herbarium, i.e. at the present time the type specimen cannot be traced at Uppsala. All other efforts to trace the existence of a Thunberg specimen bearing that name in the Montin Herbarium, Bergius Herbarium (both at Stockholm), the Fielding Herbarium at Oxford and the Banksian Herbarium in the Brit. Museum all of which are known to contain a number of Thunberg plants, proved unsuccessful.

As a result of a request made to the authorities at Uppsala for the loan of the type of *Avena antarctica* Thunb., the following sheets were received at Kew:—

(1) A sheet consisting of three culms and inflorescences of *Bromus bifidus* Thunb. collected in Japan. This sheet bore the name *Bromus bifidus* in the lower right hand corner and superimposed on this the name *Avena antarctica*. The specimen to which these last two names referred has at some time or other been removed from the sheet (traces of gum ? can still be seen on the sheet). This may have been Thunberg's plant from the Cape which now cannot be traced. Apparently *Thunberg* thus at some time or other tried to identify his Cape plant with the Japanese *Bromus bifidus*, but later superimposed the name *Avena antarctica* to replace the misidentification. This sheet furthermore bears the name *Bromus bifidus* on the lower left hand corner and next to it the name *Aira antarctica* Forst.

(2) A sheet consisting of an inflorescence of *Aira antarctica* Forst. This specimen agrees in every detail with *Forster's* co-type preserved in the Kew Herbarium and which is a plant very different from any present day known species of *Helictotrichon* from South Africa.

As a point of interest it should be mentioned that *Thunberg* visited England during December, 1778–January, 1779. He met *Forster* who showed him the plants he collected during Cook's voyage round the world. *Forster* even gave *Thunberg* a fairly large number of duplicates from his collection. These are now preserved in Thunberg's Herbarium. Thus sheet (2) mentioned above is probably an isotype of *Aira antarctica* Forst.

It may be assumed that *Thunberg* at some time removed the right hand specimen from sheet (1) and remounted it on sheet (2). This would mean that the name *Avena antarctica* Thunb. was based on a fragment of the isotype of *Aira antarctica* Forst., which is a New Zealand plant. Accordingly this name is not applicable to a South African species. It was cited in Thunb. Prodr. and Fl. Cap. merely as a result of an error. Since *Thunberg* was acquainted with *Forster*, Forster's Prodr. and plants, it is highly improbable that he would have applied the epithet "*antarctica*" to a species from the Cape. [Although the epithet was used by *Linn. fil.* to designate a Cape species, viz. *Scirpus antarcticus*, also mentioned by Thunb. Prodr. Pl. Cap. (1794)]. It is thus possible that the name *Avena antarctica* Thunb. found its way into South African literature by mistake and does not

refer to any species from the Cape but to *Forster's* New Zealand *Aira antarctica*. On the other hand it is quite possible that Thunberg's *Avena antarctica* was definitely a species from the Cape and that both specimen and name had nothing to do with Forster's *Aira antarctica*. If this is assumed, the type of *Avena antarctica* Thunb. has probably been lost since all attempts to trace its existence have failed. The absence of a type specimen is in itself not a very serious matter if the descriptions given by *Thunberg* [Prodr. Pl. Cap. l.c. or Fl. Cap. 436 (1818)] were adequate to identify a South African species by means of them. But several Cape species of *Helictotrichon* are so closely allied that it is impossible to say with certainty which of these *Thunberg* may have had before him at the time and to which particular species the name could at the present time be applied.

A study of the literature regarding *Aira antarctica* Forst. and *Avena antarctica* Thunb. has shown that these names have been the cause of some confusion.

For example *Sprengel* [Syst. Veg. 331 (1825)] under *Danthonia antarctica* cites among others as synonyms "*Aira antarctica* Forst. and *Avena* Thunb." Furthermore, *Hooker* [Fl. New Zeal. 335 (1864)] quotes *Danthonia antarctica* Spreng. under *Trisetum antarcticum* (Forst.) Trin. and consequently this name also includes the Cape species. *Juel* [Pl. Thunb. 89 (1918)] cites "*Avena antarctica* (Forst.) Thunb. Prodr. 1794, 22; Fl. Cap. 1818, 436. Siehe unter Bromus bifidus" for the Cape species and thus assumes that *Thunberg* based *Avena antarctica* on Forster's New Zealand species. Although this assumption may be correct, stress must be laid on the fact that *Thunberg* nowhere indicated that his *Avena antarctica* was actually based on *Forster's* plant. The combination *Avena antarctica* (Forst.) Thunb. is thus not justified.

Desvaux [in G. Jay, Fl. Chilen. VI. 350 (1853)] suggests that the epithet "*antarcticum*" should be retained for the New Zealand *Trisetum antarcticum* (Forst.) Trin. He creates the name *Trisetum Thunbergii* for the species from the Cape to which *Nees* applied the name *Trisetum antarcticum* based on *Avena antarctica* Thunb. *Desvaux* evidently realised that the New Zealand plant had been confused with the species from South Africa. His epithet "Thunbergii," however, is superfluous, as older specific epithets are available for the complex of species which *Nees* had placed under *Trisetum antarcticum* (Thunb.) Nees. Further information is to be found in studying the synonymy of the species enumerated in this paper.

Since two names which probably refer to related but distinct plants bearing the same specific epithet have been confused in the literature cited above and since in the absence of the type specimen the identity of the Cape plant cannot be made out with certainty, it is suggested that the name *Avena antarctica* Thunb. be regarded both as a "*nomen ambigum*" and a "*nomen dubium*" and consequently should be rejected. The name *Aira antarctica* Forst., however, should be retained for the New Zealand species of which the type and isotype specimens are extant!

VII.—ACKNOWLEDGEMENTS.

For the kind loan of material I beg to tender my thanks to the Directors or Curators of all the South African Herbaria and the following European Herbaria: Kew, British Museum, Berlin-Dahlem, Oxford, Paris, Stockholm and Uppsala. My special thanks are due to Sir Arthur Hill, Director of the Royal Botanic Gardens, Kew, for the facilities offered during the preparation of this paper. To Mr. C. E. Hubbard, F.L.S., I am very much indebted for many kind suggestions and helpful advice.

VIII.—EXPLANATION OF FIGURES.

I. H. quinquesetum (Steud.) Schweickerdt
II. H. longum (Stapf) Schweickerdt
III. H. namaquense Schweickerdt
IV. H. barbatum (Nees) Schweickerdt
V. H. leoninum (Steud.) Schweickerdt
VI. H. Galpinii Schweickerdt
VII. H. capense Schweickerdt
VIII. H. hirtulum (Steud.) Schweickerdt
IX. H. natalense Schweickerdt
X. H. longifolium (Nees) Schweickerdt
XI. H. turgidulum (Stapf) Schweickerdt
XII. H. Dodii (Stapf) Schweickerdt

The above figures show :—

1. Lower Glume.
2. Upper Glume.
3. Lemma.
4. Rhachilla-internode, anterior view (and lateral view).

Fig. I.

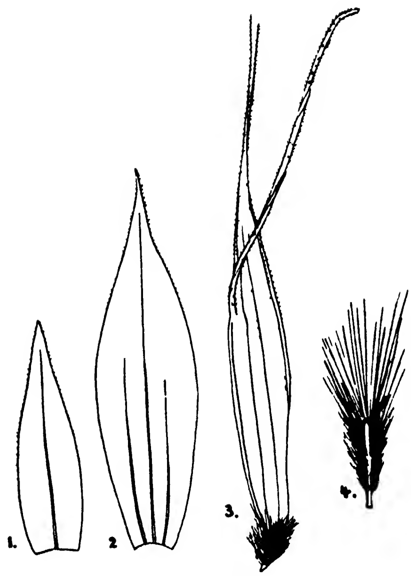


Fig. II.

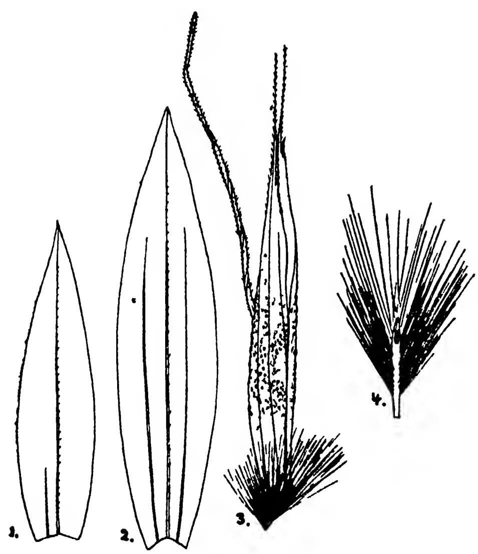


Fig. III.

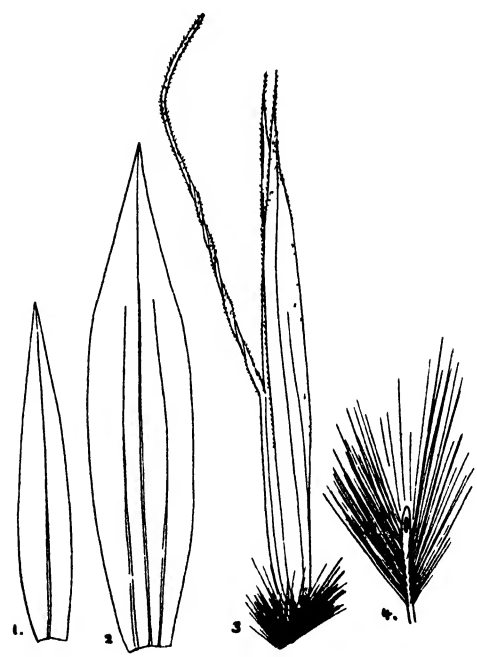


Fig. IV.

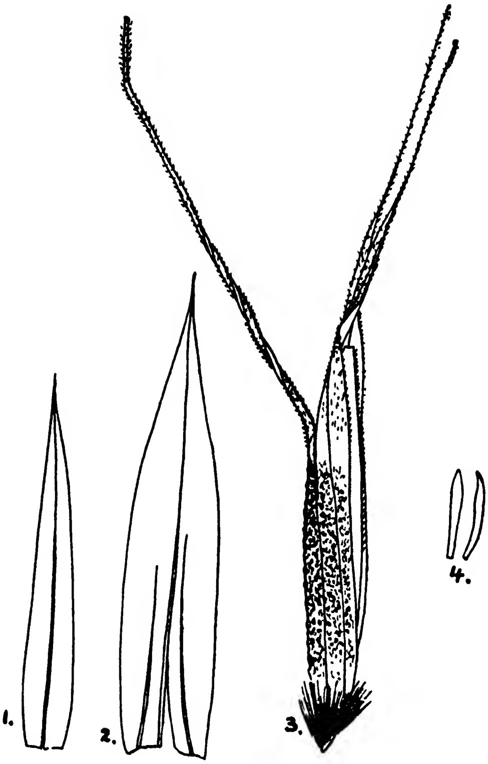


Fig. V.

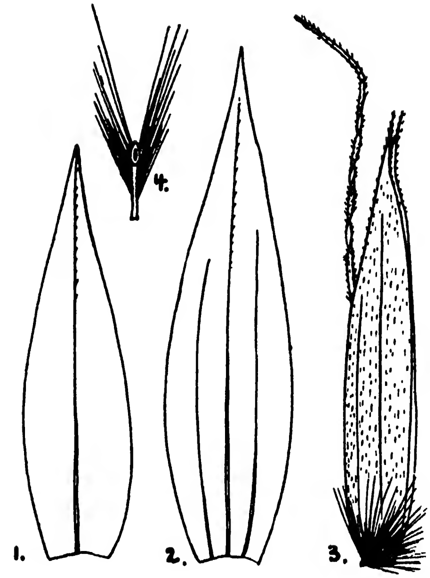


Fig. VI.

Fig. VII.

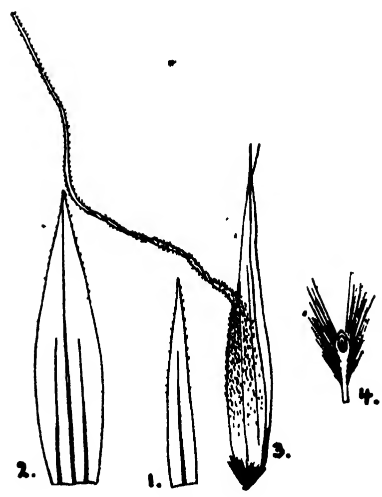


Fig. VIII.

Fig. IX.

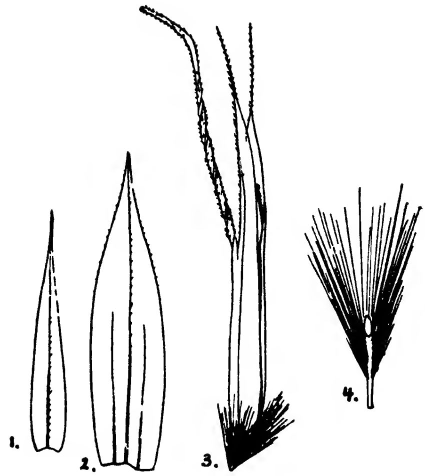


Fig. X.

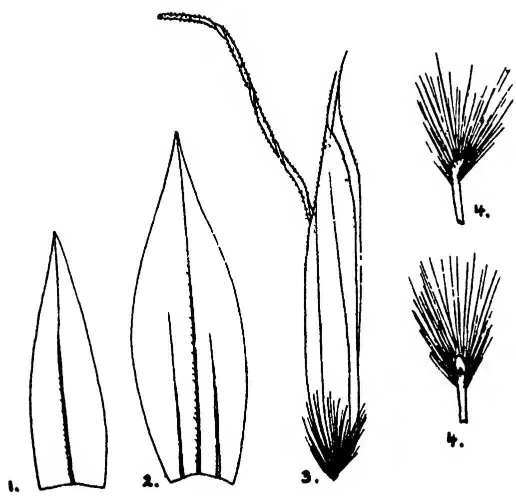


Fig. XI.

Fig. XII.

A REVISION OF THE SOUTH AFRICAN SPECIES OF *BRACHYLAENA* R. Brown.

By E. P. Phillips, M.A., D.Sc., and H. G. Schweickerdt, B.Sc., Ph.D., F.L.S.

The first two species from South Africa described by *Linnaeus* and *Lamarck* respectively were placed by these authors under the genus *Baccharis* Linn. In the modern conception, this genus has no representatives in South Africa and is restricted to North and South America. *Thunberg* was more correct, when in his *Prodr. Pl. Cap.*, he described several species under the genus *Tarchonanthus* Linn. Of these some were later referred by the authors to the genus *Brachylaena* R. Br. and have since been found to be conspecific and thus synonymous with the Linnaean and Lamarckian species. The species, however, were satisfactorily grouped when R. Brown on basis of *Baccharis neriifolia* L. created the genus *Brachylaena*, which differs in certain fundamental characters from the genus *Baccharis* L. It would be superfluous to enumerate these differences as they may readily be seen from *Benth.* and *Hook* [Gen. Pl. II. 179 and 180 (1873]), where the former is placed in the *Inuloideae* and the latter in the *Asteroideae*. *Cassini*, in Bull. Sciences. Philomat. 1817, p. 151, described the genus *Oligocarpha* on basis of *Baccharis neriifolia* L. His account, however, appeared during September, 1817, whereas R. Brown's description of *Brachylaena* (with which it is congeneric as it was based on the same species) appeared towards the middle of the same year (an exact date is not available). *Brachylaena* R. Br. consequently has priority over *Oligocarpha* Cassin. *Lessing* in his Syn. Comp. 208 (1832) correctly referred some of Thunberg's species of *Tarchonanthus* to the genus *Brachylaena*, and his conception has since been supported by *De Candolle* and *Harvey* as well as several other authors. *De Candolle's* account in Prodr. V. 430 (1836) is fairly comprehensive. Investigation of the specimens cited by that author has shown that in one or two cases the names of the species were misapplied. This is borne out more clearly by the synonomy under the species enumerated in this paper.

The name *Brachychlaena* Post et Kuntze must be regarded merely as an erroneous spelling for *Brachylaena*.

DISTRIBUTION.

The genus is a tropical one and the distribution of the species in South Africa, as with species of other tropical genera, clearly indicates the common path of the migration of such plants. In general the south western area of the Cape Province is invaded by migration along the eastern coastal belt and from Humansdorp westward through the area lying south of the Zwartbergen Range of mountains. In the South African flora it is not uncommon to find representatives of tropical genera as far south as East London or even Bathurst where palms are found native. The two species *B. elliptica* and *B. ilicifolia* show a typical distribution in South Africa of species with tropical affinities, i.e. they range from Natal as far as Uitenhage. A similar distribution is shown by *B. discolor* but whose southern limit is Bathurst. When the species mingle with the true Cape flora they can easily be mistaken for an integral part of the original flora unless the distribution of the genus is traced. It may be significant that the two species found in the area of the Cape flora (*B. neriifolia* and *B. glabra*) have quite glabrous leaves whereas the other South African species have leaves which are tomentose beneath. *B. neriifolia* ranges from Clanwilliam, southward

through Ceres and then in the southern districts as far as Humansdorp. It is also found on the summit of the mountain ranges which carry a typical Cape flora and is a characteristic element in the vegetation of the south-western districts of the Cape Province. *B. glabra* has not become a typical "Cape" plant as *B. neriifolia* and though it has been recorded from the Caledon district it still indicates its tropical affinities by having an eastern distribution as far as Natal. One species *B. transvaalensis* is confined to the mountainous region of the north-eastern Transvaal and has probably entered from P.E. Africa as it is also found at Lourenco Marques from where it has migrated southward into Zululand. *B. rotundata* is confined to the Transvaal Highveld and Bushveld while another species *B. huillensis* is only known from a single specimen collected in the Kruger National Park. *B. uniflora* is confined to Natal.

BRACHYLAENA, *R. Br.*, in Trans. Linn. Soc. XII. 115 in not. (1817); *DC.*, Prodr. V. 430 (1836); *Harv.*, Gen. S.A. Pl. 169 (1838); *Harv.* et *Sond.*, Fl. Cap. III. 115 (1865); *Benth.* and *Hook.*, Gen. Plant. II. 288 (1873); *Engl.* and *Prantl,* Pflanzenfam. IV. 5. 174 (1890).

Heads many to few-flowered, unisexual. *Receptacle* naked. *Involucral scales* imbricate, dry, shorter than the florets; in fruit longer or shorter than the achenes. *Corolla* tubular, unequally 5-lobed. *Male flowers*: bisexual; anthers tailed at the base, connate, exserted; style filiform, simple or bifid; ovary hispid, abortive; pappus sparingly developed. *Female flowers*: anthers abortive, separate; style bifid; achenes pubescent or subglabrous; pappus of bristles in two rows.

Dioecious shrubs or trees. Leaves alternate, coriaceous, shortly petiolate or subsessile, entire or toothed, glabrate above, often tomentose beneath. Capitula in racemes or panicles. Flowers yellow. Geograph. distribution: Africa and Mascarene Islands.

Syn.: *Oligocarpha* Cass., in *Bull. Soc. Philomatique*, 1817, p. 151; *Journ. de Physique LXXXVII.* 26 (1818). *Brachychlaena* Post et Kunze, *Lexic. gen. Phan.* 77 (1903).

KEY TO SPECIES.

Leaves glabrous beneath, very rarely rusty tomentose:
- Leaves usually long-lanceolate, 5–8 times longer than broad........ 1. *neriifolia.*
- Leaves usually elliptic or obovate, 2–4 times longer than broad..... 2. *glabra.*

Leaves white or greyish tomentose beneath:
- Male heads 1–3-flowered.. 3. *uniflora.*
- Male heads 7–50-flowered:

Leaves distinctly mucronate:
- Involucre of bracts 3–4-seriate; bracts densely albo-tomentose.. 4. *huillensis.*
- Involucre of bracts 5–8-seriate; bracts never white tomentose.. 5. *ilicifolia.*

Leaves not mucronate:
- Heads usually less than 1 cm. long; the innermost bracts scarcely as long as the fruits:
  - Leaves with petioles 1 or more cm. long, generally over 2 cm. broad 6. *transvaalensis.*
  - Leaves sessile or subsessile, rarely up to 1·5 cm. broad......... 7. *elliptica.*
- Heads usually over 1 cm. long; the innermost bracts longer than the fruits and hiding them:
  - Involucre of female heads 6–7-seriate; style not swollen at the base (a Transvaal and Rhodesian species).................. 8. *rotundata.*
  - Involucre of female heads 7–10-seriate; style swollen at the base (Cape Province and Natal)................................ 9. *discolor.*

1. B. neriifolia (L.), *R. Brown*, in Trans. Linn. Soc. XII. 115 in not. (1816); *Steud.*, Nomencl. I. 98 (1821); *Less.*, Syn. Comp. 208 (1832); *DC.*, Prodr. V. 430 (1836); *Drège*, Zwei Pflzgeogr. Docum. 169 (1843); *Krauss*, in Flora. 1844. p. 671; *Dietrich*, Fl. Univ. N. Folge, t. 4 (1849); *Harvey*, Fl. Cap. III. 116 (1865); Bibl. Bot. X. No. 52. 18 (1901); *Bolus* and *Wolley-Dod*, in Trans. S. Afr. Phil. Soc. XIV. 3, 277 (1903); *Sim*, Forest Flor. C.G.H. 246 (1907); *Juel*, Plant. Thunb. 381 (1918); *Sim*, Native Timb. S. Afr. 44 (1921).

Syn.: *Baccharis neriifolia* Linn., Sp. Pl., 860 (1753); Willd., Sp. Pl., III, iii, 1914 (1804); Pers., Syn., II, 423 (1807); Steud., Nomencl., I, 98 (1821); Spreng., Syst. Veg., III, 462 (1826).

Tarchonanthus lanceolatus Thunb., Prodr. Pl. Cap., 145 (1794); Willd., Sp. Pl., III, iii, 1793 (1804); Pers., Syn., II, 405 (1807); Steud., Nomencl., II, 826 (1821); Thunb., Fl. Cap. ed. Schult., 638 (1823); Spreng., Syst. Veg., III, 456 (1826).

Oligocarpha neriifolia Cass., Dict. Sc. Nat., XXXVI, 21 (1817).

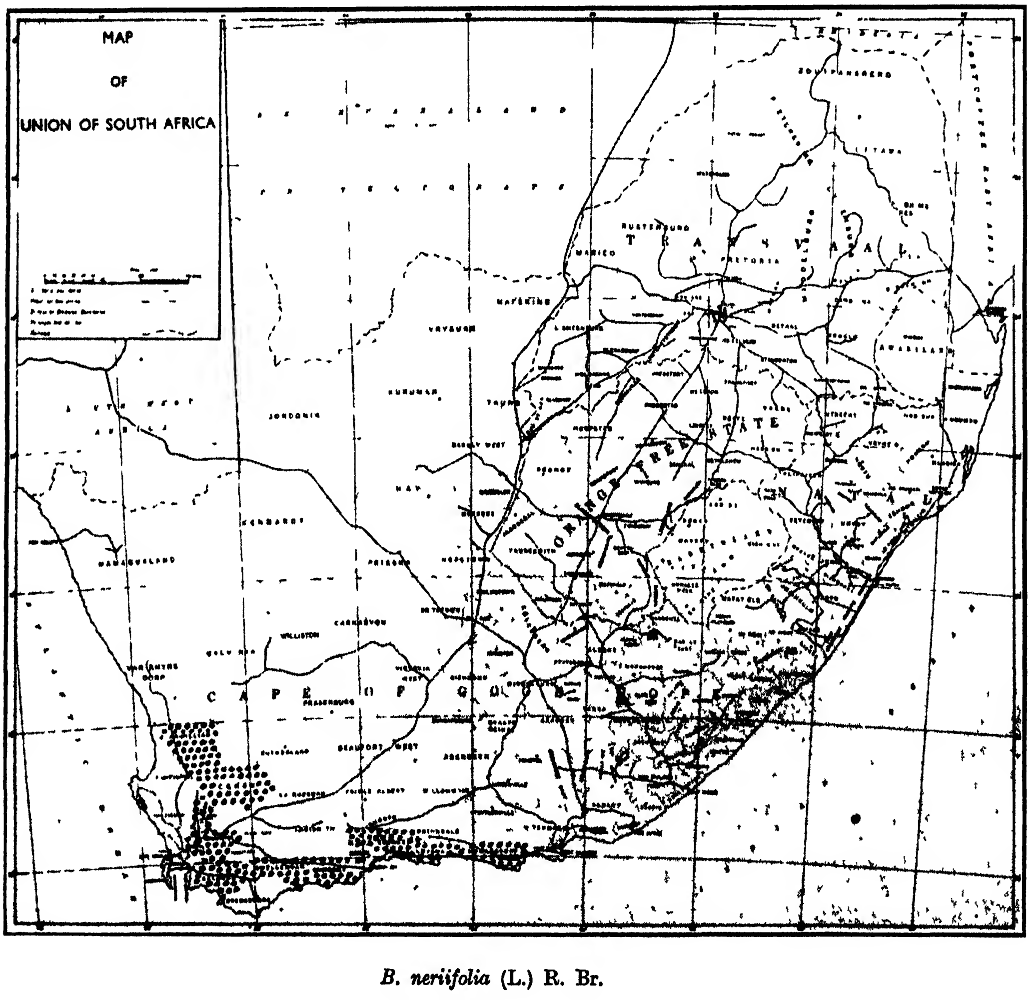
Conyza neriifolia L'Hér. ex Steud., Nomencl., I, 98 (1821).

Tarchonanthus dentatus Eckl. and Zeyh. ex DC., Prodr., V, 430 (1836), non Thunb.

Branches grooved, glabrous or minutely puberulous. *Leaves* 2–11 cm. long, 0·5–1·8 cm. broad (5–8 times longer than broad), usually lanceolate, more rarely lanceolate-linear or oblanceolate, obtuse, with the midrib prominent or distinct beneath, and with close reticulate veining, attenuated at the base into a short petiole, entire, very rarely one or two toothed, glabrous. *Inflorescence* a terminal or axillary panicle, more rarely a raceme, 3–9 cm. long. Male heads: *Involucre* 2–5-seriate; bracts 1–3 mm. long, 1–3 mm. broad, ovate, more rarely ovate-elliptic or broadly elliptic, obtuse, usually with membranous margins. *Heads* 7–14-flowered. *Corolla-tube* 2–3 mm. long, cylindric, glabrous; lobes 1·5–4 mm. long, linear, linear-lanceolate, obtuse or subobtuse, very rarely sparsely glandular without. *Filaments* 1–2 mm. long, linear; anthers 1·75–2·5 mm. long, linear, acute, tailed at the base. *Ovary* 0·75–2 mm. long, pubescent, very rarely glabrous; style 4–7 mm. long, cylindric, sometimes bulbous at the base, 0·5–1 mm. long, linear, oblong, ovate or ovate-lanceolate, obtuse or subacute. *Pappus* 3–4 mm. long. Female heads: *Involucre* 4–5-seriate. *Bracts* 2–4 mm. long, 1–3 mm. broad, ovate to lanceolate, obtuse, rarely ciliate, glabrous, sometimes with membranous margins. *Heads* 6–11-flowered. *Corolla-tube* 2·5–3·5 mm. long, cylindric, glabrous, rarely sparsely glandular; lobes 1–2 mm. long, linear, obtuse. *Ovary* 1–1·5 mm. long, oblong in outline, pubescent or glandular; style 4·5–6 mm. long, cylindric; lobes ·5–·75 mm. long, linear, oblong or linear-lanceolate, acute or subobtuse. *Pappus* 3–5 mm. long.

Cape Province.—Without locality: *E.* and *Z. in Nat. Herb.*, 11934!; *Schonland*, 576!; *Thom*, 950!; *Niven*!; *Wallich*! Clanwilliam distr.: Wupperthal, *Drège*; Pakhuis Pass, in very sandy spots under bushes and rocks, very rare, *Leipoldt in Govt. Herb.*, 1905!; *Rogers*, 16836!. Ceres distr.: Mountains at Mitchell's Pass, Febr., *Schlechter*, 9960!; Laaken Vlei, at foot of Matroosberg, 3,500 ft., *Phillips*, 1926! and *in Herb. Mus. Austro-Afric.*, 11726!; near Ceres, *Thode*, A2250!. Paarl distr.: Banks of upper Berg River, south of Roberts' Vlei, shrub 4–10 ft., *Pillans*, 6754!; French Hoek Pass, on banks of River Zonder Einde *Galpin*, 12382!; river banks, Klein Drakenstein Mountains, near farm Saleni, *Galpin*, 11044!; in respectibus Paarlberg, *Drège*!. Stellenbosch distr.: Stellenbosch, 2,000–4,000 ft., *Ecklon*, and *Zeyher*!. Caledon distr.: Nieuwe Kloof, Houw Hoek Mountains, *Burchell*, 8080!; Steenbras River at Sir Lowry's Pass, *MacOwan*, 184!; near Steenbras River, 900 ft., *Bolus in Natal Govt. Herb.*, 2559! and *in Herb. Wood*, 3802! and *in Herb. Norm. Austro-Afric.*, 184!; Hermanus, *de Beer in Herb. Transv. Mus.*, 16529!; near Hermanus, *Smuts*, 1204!; *Caledon*, *Elbrecht in Herb. Transv. Mus.*, 22126!; Hottentots' Holland Mountains, *Zeyher*!. Worcester distr.: On mountains above Worcester, *Rehmann*, 2657; Hex River Valley, 2,000 ft., *Tyson*, 757!; near De Doorns, *Bolus in Nat. Herb.*, 21079!; Du Toits Kloof, *Marloth*, 635!;

12746!; Waterkloof, 20 miles south of Worcester, *Andreae*, 332!. Tulbagh distr.: Tulbagh Waterfall, 600 ft., Febr., *Schlechter*, 7511!; *Mund*!. Wellington distr.: Baines Kloof, *Smith*, 2686!. Swellendam distr.: Swellendam, 500–2,500 ft., *Mund*!; *Kuntze*!; *Smith*, 2733!; between Grootvaders Bosch and Zuurbraak, *Burchell*, 7260!; Zuurbraak, *Thode*, A2332!. George distr.: George, *Patterson*, 1267!; in moist woods, *Prior*!; The Wilderness, Febr., *Moss*, 5613!; Montagu Pass, *Schweickerdt in Nat. Herb.*, 21080!. Knysna distr.: Plettenberg Bay, *Pappe*!; *Zeyher*!; near Deepwalls, *Phillips in Herb. Forest Dept.*, 5512!; 5497!; Forest Station, *Schonland*, 3583!; Gouna River, *Keet in Herb. Forest Dept.*, 2754; Lily Vlei Forest, *Keet*, 712! and *in Nat. Herb.*, 2108, 3322!; Plettenberg Bay, *Rogers*, 26787!. Riversdale distr: Corente River, *Muir*, 214!; Glen, *Muir in Nat. Herb.*, 3719!. Humansdorp distr.: Ratels Bosch, Zitzikamma, *Fourcade*, 576!; north side of Kromme River, near Wagenboom Station, *Burchell*, 4850!; Lottering River, Zitzikamma, *Galpin*, 9489!, 4130!; Witkliprivier, *Marloth*, 13064!; Storm's River, *Zahn in Herb. Forest Dept.*, 4049!, 4095!. Oudtshoorn distr.: Cango Valley, *Marloth*, 12130!. Prince Albert distr.: Zwartberg Pass, near Kliphuis Vlei, *Pocock in Nat. Herb.*, 21082!.



B. neriifolia (L.) R. Br.

Common in the Knysna district on banks of mountains and forest streams, up to 6 ft. high and 1–2 in. stem diameter; sometimes a tree 15–18-ft. high. Common name "Water Wit-Els."

The type specimens deposited in the *Herb. Linn. Soc. Lond.* and the *Hort. Cliffort.* in *Herb. Mus. Brit.* consist of sterile material. The leaves and branches of these resemble modern gatherings in every respect; furthermore the characteristic rusty brown indumentum on the young parts, leaves very little doubt as to the identity of the species.

2. B. glabra (L.f.) *Druce*, in Rep. Bot. Exch. Cl. Brit. Isles, 1916, p. 611 (1917).

Syn.: *Tarchonanthus glaber* Linn., f. Suppl., 360 (1781); Linn., f. Syst. Nat., ed. 13, 1204 (1791); Steud., Nomencl., II, 826 (1821); Thunb., Fl. Cap. ed. Schultes, 638 (1823).

Tarchonanthus dentatus Thunb., Prodr. Pl. Cap., 145 (1794); Willd., Sp. Pl. III, iii, 1793 (1804); Pers., Syn., I, 405 (1807); Steud., Nomencl., II, 826 (1821); Thunb., Fl. Cap. ed. Schultes, 638 (1823).

Brachylaena grandifolia DC. Prodr., V, 430 (1836); Drège, Zwei Pflzgegor. Doc., 135 (1843).

Brachylaena dentata (Thunb.) Less., Syn. Comp., 208 (1832); Harv., Fl. Cap., III, 116 (1865); Sim, Forest Flor. C.G.H., 246 (1907); Wood, Flor. Natal, 169 (1908); Juel, Plant. Thunb., 381 (1918); Sim, Native Timb. S. Afr., 44 (1921); Bews, Flor. Nat. and Zulul., 215 (1921); Henkel, Woody Pl. Nat. and Zulul., 72 (1934).

Branches grooved, minutely tomentose or glabrescent. *Leaves* distinctly petioled, 3–13·5 cm. long, 1·2–4·5 cm. broad, elliptic-lanceolate, obovate, elliptic-oblong, rounded, subacuminate or distinctly acuminate, obtuse, with the mid-rib and lateral veins distinct beneath, narrowed at the base, entire or sinuate-toothed near the apex, glabrous or more rarely rusty tomentose beneath; petiole 1–1·5 cm. long, concave above, convex beneath. *Inflorescence* a terminal or axillary panicle, 2·5–12 cm. long, rarely up to 15 cm. long. Male heads: *Involucre* 3–6-seriate; bracts 1·75-5 mm. long, 2–4 mm. broad, elliptic, ovate-elliptic, ovate, obtuse, sometimes with membranous margins. *Heads* 13–24-flowered. *Corolla-tube* 2–4·5 mm. long, cylindric, sometimes subcampanulate above, glabrous; lobes 1·5–3 mm. long, linear, linear-lanceolate, obtuse or subobtuse. *Filaments* 1–2 mm. long, linear; anthers 2-3 mm. long, linear, acute, tailed at the base. *Ovary* 1·5–2 mm. long, oblong in outline, pubescent, more rarely villous; style 5–7 mm. long, cylindric; lobes 0·5–1 mm. long, linear, linear-lanceolate or ovate-lanceolate, obtuse or subobtuse. *Pappus* 4–4·5 mm. long. Female heads: *Involucre* about 6-seriate. *Bracts* 2–3 mm. long, 1·5–3 mm. broad with membranous edges; the outer ovate, obtuse; the inner linear to lanceolate. *Heads* 4–5-flowered. *Corolla-tube* 4 mm. long, cylindric; lobes 1·25 mm. long, linear-lanceolate, subobtuse. *Ovary* 3·25 mm. long, terete, linear in outline, shortly villous; style 6 mm. long, cylindric; lobes 1 mm. long, oblong-linear, obtuse.

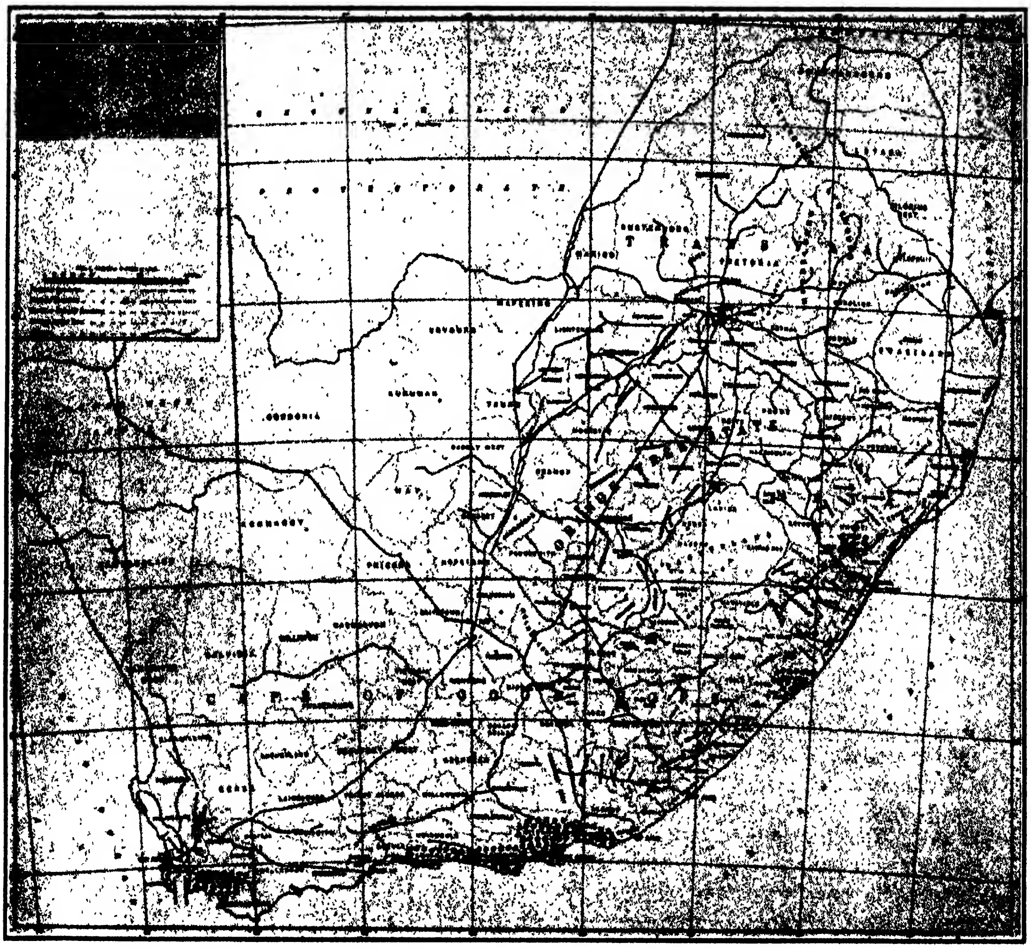
Cape Province.—Without precise locality: In Cap. b. spei circa Essenbosch rivum, Nov., *Thunberg* (2 sheets in *Herb. Thunberg, Uppsala*)!. Caledon distr.: Hermanus, *Smuts in Herb. Marloth*, 11905!. Knysna distr.: Stinkhout Bosch, *Sim* and *Newson in Herb. Forest Dept.*, 2236!. Humansdorp distr.: *Clarkson*; *Thode*, A 860!; Storm's River, *Zahn in Herb. Forest Dept.*, 4050; Kwaaibrand Forest, 700 ft., *Burton in Herb. Forest Dept.*, 40!; near the mouth of the Storm's River, 200 ft., *Fourcade*, 537!; Stinkhout Bosch, about 2,000 ft., *Ross in Herb. Forest Dept.*, 2061!; *Sim* and *Hewson in Herb. Forest Dept.*, 2236!; Storm's River, *Keet*, 543! and *in Herb. Forest Dept.*, 3064!. Port Elizabeth distr.: Waterfall at Van Staden's River, *MacOwan*, 2076!; Van Staden's Mountains, *Zeyher*, 2785!; *Patterson*, 879!; Longmore Forest Reserve, *Long*, 1051!. Alexandra distr.: Zuurbergen, 2,000–3,000 ft., *Drège*!. Lusikisiki distr.: Egossa Forest, *Sim*, 2395!. Uitenhage distr.: Eastern slopes Eland's River Mountains, *Sim in Herb Forest. Dept.*, 2102!.

NATAL PROVINCE.—Without precise locality, *Garrard*, 1512!; edge of wood, Noodsberg, *Wood*, 5274!, 4129! and *in Natal Govt. Herb.*, 4731!.

Ross in Herb. Forest Dept., 2062 may be a water shoot of the species; if so then the leaves are closely tomentose beneath.

Found in some quantity in Kwaaibrand Forest (Humansdorp distr.) which is almost entirely on Table Mountain sandstone. Common name "Malbar."

According to notes on various sheets this species is a tree of "considerable height" (40–50 ft.) the stem of which may reach a diameter of 10–12 inches. It is a good waggon-wood and is common in parts of the coast region, especially in open places along road-margins in high forest (*Keet*).

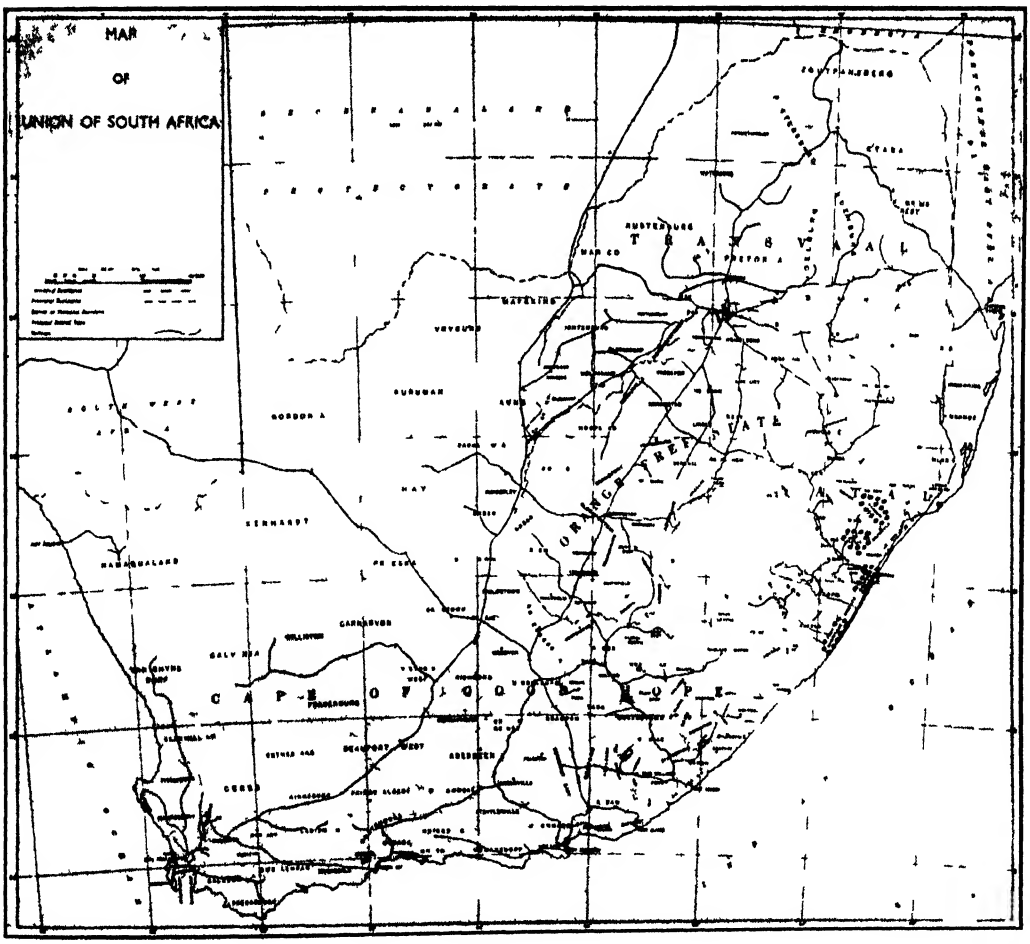


B. glabra (L. fil.) Druce.

3. B. uniflora *Harv.*, Fl Cap, III, 117 (1865), *Wood*, Flor Natal, 170 (1908), *Bews*, Flor Nat and Zulul, 215 (1921)

Type specimen deposited in *Herb Hort Bot Reg Kew*

Branches slightly grooved, glabrous or the younger parts minutely tomentulose *Leaves* petioled, 6–12 cm long, 1 5–4 cm broad, elliptic lanceolate, obovate, obovate oblong to oblong-lanceolate, sometimes subacuminate or acuminate, rounded or obtuse at the apex, narrowed at the base, entire or with crenate serrated margins in the upper portion, with the mid-rib and lateral veins prominent beneath petiole 0 5–1·5 cm long, convex beneath, channelled above *Inflorescence* a dense panicle, terminal or axillary, 5–8 cm long, the ultimate heads corymbose Male heads *Involucre* 5 6-seriate bracts 0 5–2 mm long, ovate to lanceolate or elliptic lanceolate, obtuse, sometimes with membranous margins *Heads* 1–3-flowered more or less elongated, about 3 mm long and 1 mm in diameter *Corolla-tube* 2 3·5 mm long, cylindric, sometimes subcampanulate above, lobes 1–2·5 mm long, lanceolate, oblong-lanceolate or linear-lanceolate, obtuse or subacute *Filaments* 1 mm long, linear anthers 1–1 75 mm long, linear, acute, tailed at the base



B. uniflora Harv.

Style 3·5–6 mm. long, cylindric ; lobes 0·5 mm. long, ovate, obtuse or subobtuse. *Pappus* 3·5 mm. long. Female heads : *Involucre* about 6-seriate ; bracts 1·25–3 mm. long, about 1 mm. broad, ovate to elliptic, obtuse, with membranous margins. *Heads* 4-flowered, about 3·5 mm. long, and 1·5 mm. in diameter. *Corolla-tube* 2·5 mm. long, cylindric ; lobes 0·5 mm. long, lanceolate, subacute. *Ovary* terete, pubescent ; style 3 mm. long, cylindric ; lobes 0·5 mm. long, ovate, subobtuse. *Pappus* 3 mm. long.

NATAL PROVINCE.—Without precise locality : No collector, *in Natal Herb.*, 778! ; *Gerrard*, 29!; *Gerrard* and *McKen*, 1866! and *in Natal Govt. Herb.*, 11006!. Port Shepstone distr. : Amanzimtoti, *Kotze*, 432! and *in Herb. Forest Dept.*, 6854!. Pinetown distr. : Durban, *Wood*, 12670 ! ; Sydenham, *Wood*, 12287 ! ; Dumisa, *Rudatis*, 653!, 1052!. Inanda distr. : Inanda, 1,800 ft., *Wood*, 585! and *in Natal Govt. Herb.*, 2826!. New Hanover distr. : On rocky hill, Great Noodsberg, *Wood*, 4129! and *in Natal Herb.*, 4731!. Kranskop distr. : Qudeni Forest, *Davis*, 82! and *in Natal Govt. Herb.*, 8816!.

A common large tree in the Hlatikulu Forest, Zululand.

A species which was only imperfectly known at the time Vol. III of the Flora Capensis was being compiled, but additional material collected since has enabled the authors of this paper to draw up the accompanying description of both male and female plants.

According to *Rudatis* this species reaches a height of up to 20 metres.

4. B. huillensis O., *Hoffm.*, in Engl. Jahrb., XXXII, 149 (1902).

A tree. *Branches* striate and grooved, glabrous in age ; the young parts densely minutely albo-tomentulose. *Leaves* petiolate ; petiole 7–10 mm. long, channelled above, convex below, densely albo-tomentulose ; lamina up to 7·5 cm. long and 2·0 cm. broad, oblanceolate, conspicuously mucronate, acute, cuneate towards the base, and towards the apex often somewhat undulate, glabrous, shiny and conspicuously veined above, densely albo-tomentulose and inconspicuously veined beneath. *Inflorescence* consisting of pendunculate glomerate capitula, about 15–20 mm. long ; capitula at length sub-corymbose. *Male heads* : *Involucre* 3–4-seriate ; bracts 1–2·5 mm. long, ovate to ovate-oblong, subacuminate or obtuse, densely albo-tomentose. *Heads* 7–8-flowered, more or less globose, 3 mm. long and 2·5 mm. in diameter. *Corolla-tube* 2·0 mm. long, narrowly funnel-shaped, glabrous ; lobes 2 mm. long, oblanceolate, acute or subobtuse. *Filaments* 0·6 mm. long ; anthers 1–1·75 mm. long, linear, acute, tailed. *Style* 3·5 mm. long, cylindric ; style-branches 0·6 mm. long, subacuminate. *Pappus* setose ; bristles 2·5–3 mm. long.

TRANSVAAL PROVINCE.—Zoutpansberg distr. : Punda Maria, Kruger National Park, *Lang* s.n., in *Herb. Tvl. Mus.*, 32343!.

The above gathering consists of a male specimen only, and thus strictly speaking cannot be compared with the type specimen of *B. huillensis* which is female. Our plant, however, resembles the latter in characters of foliage and habit so closely, that we do not hesitate in referring it to that species. *Leemann* 24 from the Blaauwberg, Pietersburg distr., which is in leaf only is probably this species.

The description given above was drawn up solely from the Transvaal specimen cited. This was done with a view to simplifying any questions regarding synonomy should our plant eventually (after the female has become known from the Transvaal) prove to be a species distinct from the Angolan *B. huillensis* O. Hoffm.

5. B. ilicifolia (Lam.) *Phillips et Schweickerdt*, comb. nov.

Syn. : *Baccharis ilicifolia* Lam., Encycl. Method. bot., i, 345 (1783) ; Steud., Nomencl., I, 98 (1821).

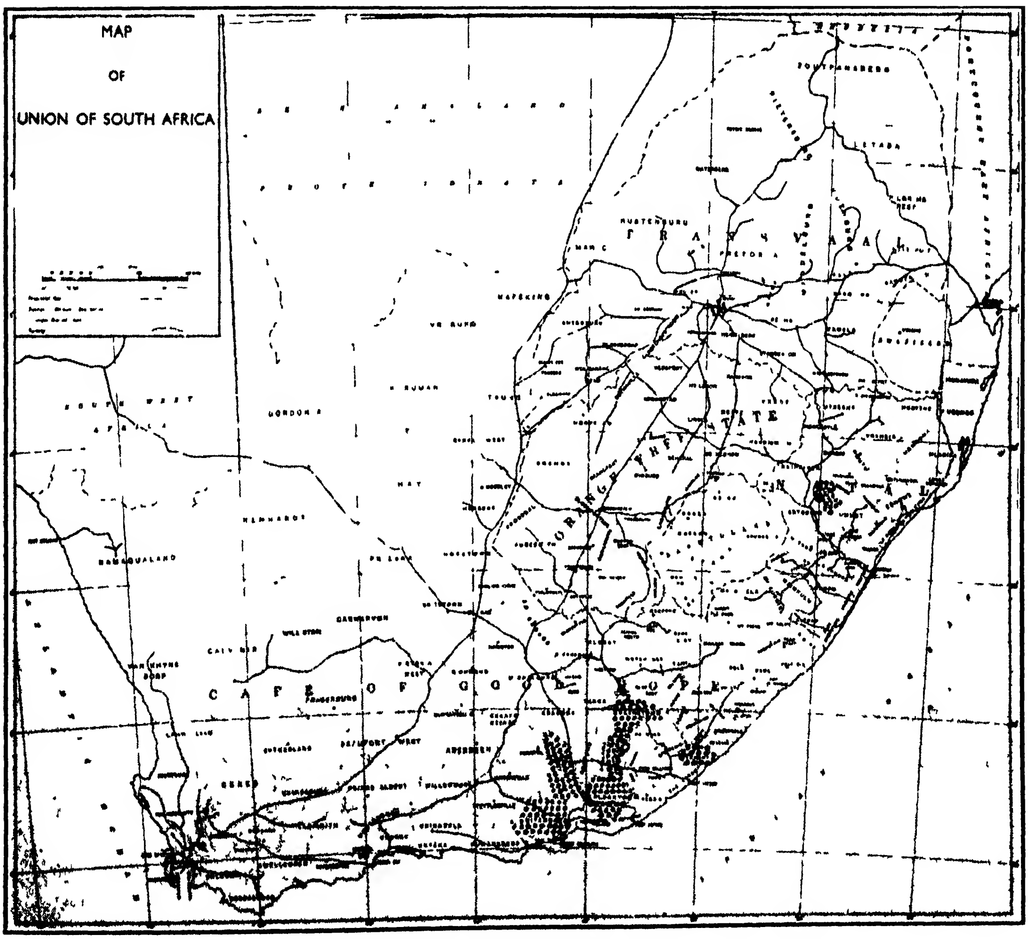
Tarchonanthus racemosus Thunb., Prodr. Pl. Cap., 145 (1794) ; Thunb., Fl. Cap. ed. Schultes, 638 (1823) ; Sprengel, Syst. Veg., III, 456 (1826), sub *T. ellipticus* Thunb.

Brachylaena racemosa (Thunb.) Less., Syn. Comp., 208 (1831); DC., Prodr. V, 430 (1836); Harvey, Fl. Cap., III, 116 (1865); Sim, Forest Fl. C.G.H., 246 (1907); Wood, Fl. Natal, 170 (1908); Juel, Plant Thunb., 381 (1918); Sim, Native Timb. S. Afr., 44 (1921); Bews, Flor. Nat. and Zulul., 215 (1921); Henkel, Woody Pl. Nat. and Zulul., 72 (1934).

Brachylaena elliptica DC., Prodr., V, 430 (1836), excl. syn., non Less.!; Drège, Zwei Pflzgeogr.—Doc., 47 et 137 (1843).

The type specimen is deposited in *Herb. Lamarck, Mus. Hist. Nat., Paris.*

Branches grooved, minutely tomentulose or glabrous. *Leaves* subsessile or shortly petioled, 1 4·5 cm. long, 0·25–1 cm. broad, oblong, oblong-obovate, oblong-lanceolate to linear, mucronate at the apex, rarely without a mucro, slightly narrowed to the base, with the mid-rib prominent or distinct but lateral veins hidden, usually entire, sometimes with a few teeth, glabrous above, albo-tomentose beneath; petiole up to 2 mm. long. *Inflorescence* axillary, few-headed, rarely of a solitary head, usually shorter than the leaves *Male heads: Involucre* about 5-seriate; bracts ovate, ciliate. *Heads* 9–11-flowered, more



B. ilicifolia (Lam.) Phill. and Schw.

or less globose, about 3·5 mm. long, about 4 mm. in diameter above. *Female heads*: *Involucre* 5–8-seriate; bracts 1·5–5 mm. long, ovate to linear-oblong, obtuse, ciliate. *Heads* 10-flowered, campanulate, 5·6 mm. long, 2·5 mm. in diameter above. *Corolla-tube* 4–5·5 mm. long, cylindric, glabrous; lobes 0·5–3 mm. long, linear or linear-lanceolate, obtuse. *Ovary* 2 mm. long, somewhat angled, pubescent; style 5 mm. long, cylindric; lobes 0·5 mm. long, linear, obtuse.

Cape Province.—Without precise locality, de Mr. *Sonnerat* (Herbier de Lamarck); in sylvula Kuka, Dec., *Thunberg* (2 sheets)!. British Kaffraria: Without precise locality, *Cooper*, 408! and *in Natal Govt. Herb.*, 8336!. Uitenhage distr.: Uitenhage, moist shady places, *Prior*; near Uitenhage, *Burchell*, 4450!; woods by the Zwartskops River, *Ecklon* and *Zeyher*, 481!, 891!; Van Staden's River Mountains, 1,000–3,000 ft., *Wallich*!; at Uitenhage, *Bowie*!. Port Elizabeth distr.: Fish River, *Zeyher*, 819!; Redhouse, *Patterson*, 959!; Zwartkops, *Marloth*, 6110!. Albany distr.: Without precise locality, *Prior*!. Komgha distr.: Among shrubs, near Komgha, 1,800 ft., *Flanagan*, 406!. Fort Beaufort distr.: Kat River, 800–1,000 ft., *Baur*, 1077!. Somerset East distr.: By the Little Fish River, *Burchell*, 3267!; between Zuurberg Range and Klein Bruintjies Hoogte, 2,000–3,000 ft., *Drège*!; between Little Fish River and Commandagga, *Burchell*, 3276!. Queenstown distr.: Between Shiloh and Table Mountain, stony and rocky places, 4,000 ft., *Drège*!; Junction Farm, *Galpin*, 8126!.

Natal Province.—Without precise locality, *Gerrard*, 1018!. Weenen distr.: *Sutherland*!.

The intensely bitter leaves of this species are said to be a good remedy for diabetes.

Comparison of the types of *Baccharis ilicifolia* Lam., and *Tarchonanthus racemosus* Thunb. has shown these two plants to be conspecific, and consequently Lamarck's epithet has priority.

6. B. transvaalensis *Phillips* and *Schweickerdt*, sp. nov.; *B. Hutchinsii* Hutch. *affinis, sed bractes capituli masculi minoribus et multiseriatis distinguitur.*

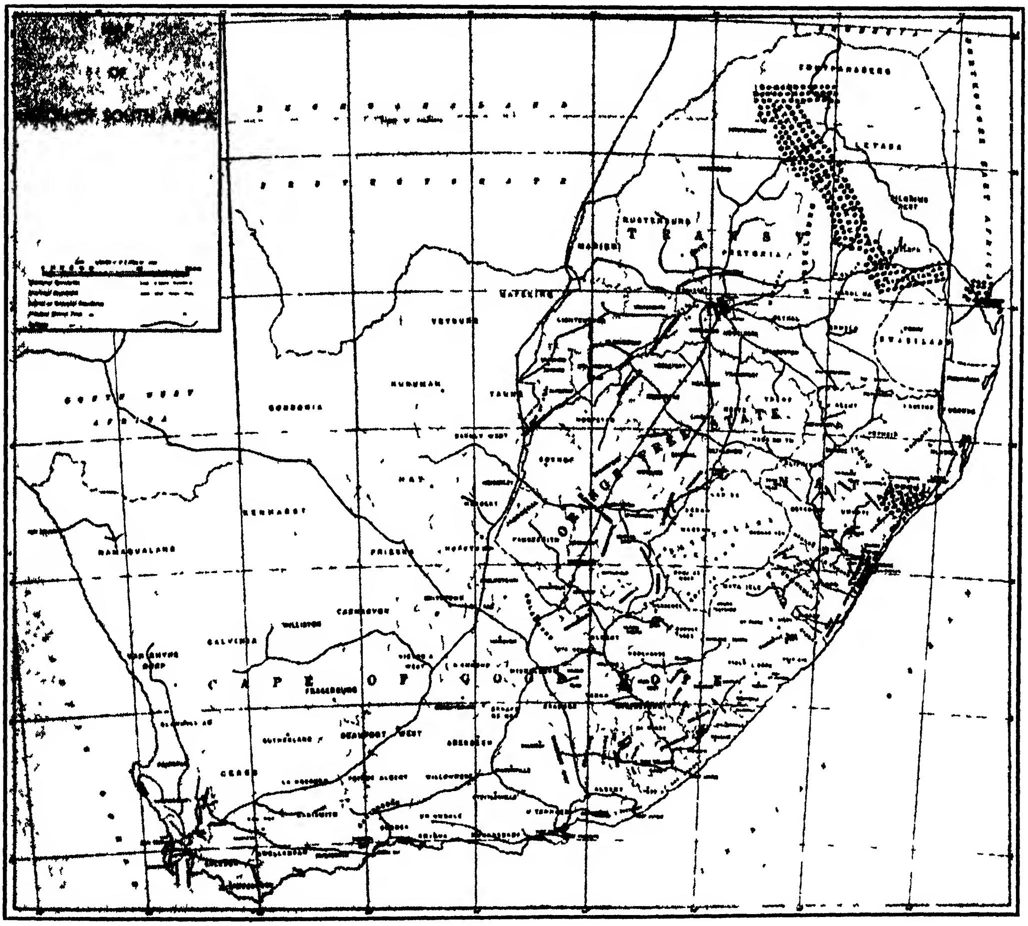
Arbor. *Rami* striati, minute tomentulosi, vel glabri. *Folia* petiolata, 3·5–16·5 cm. longa, 1·2–3·7 cm. lata, lanceolata, elliptico-lanceolata vel obovato-lanceolata, nonnunquam breviter acuminata, rotundata vel obtusa, perraro acuta, integerrima vel margine dentata et undulata, supra glabra, subtus albo-tomentosa; petiolus 1–1·2 cm. longus, supra canaliculatus, subtus convexus. *Inflorescentia* e paniculis terminalibus vel axillaribus sistens, 4·5–16 cm. longa; capitula deinde subcorymbosa. *Capitulum masculinum*: *Involcrum* 4–6-seriatum; bracteae 1–2 mm. longae, ovatae vel ovato-lanceolatae vel lanceolatae, obtusae, plus minusve tomentosae, marginibus membranaceae vel ciliatae. *Capitula* 11–16-flora, plus minusve globosa, 2 mm. longa et 2·5 mm. diametro. *Corollae* tubus 3–3·5 mm. longus, cylindricus, glaber; lobi 2 mm. longi, lanceolati, obtusi vel subacuti. *Filamenta* 0·5–1 mm. longa, linearia; antherae 1·5–2 mm. longae, lineares, acutae, caudatae. *Stylus* 5·5–6 mm. longus, cylindricus; lobi 0·5 mm. longi, ovati, nonnunquam subacuminati, acuti et obtusi. *Capitulum feomineum*: *Involucrum* 6-seriatum; bracteae 1·5–4 mm. longae, ovatae vel ovato-ellipticae, obtusae vel subacutae, glabrae vel sparse tomentosae. *Capitula* 8-flora, ambitu plus minusve obovata, circiter 3·5 mm. longa et 3 mm. diametro. *Corollae* tubus 3·5 mm. longus, angulatus; lobi 0·5 mm. longi, ovati, sub-acuti. *Ovarium* 3·5 mm. longum, pubescens, teres; stylus 5 mm. longus, cylindricus, basin versus incrassatus; lobi 0·75 mm. longi, ovato-lanceolati, subobtusi.

Transvaal Province.—Pietersburg distr.: Forest between Woodbush and Haenertsburg, 4,000–6,000 ft., *Hutchins* (type! deposited in *Herb. Hort. Bot. Reg. Kew*); *O'Connor in Herb. Forest Dept.*, 1471!, 3559!; Woodbush, *Hoffman*, 79!; no collector *in Herb. Transv. Mus.*, 9703!; Tzaneen, Pigeon Hole Farm, *McCallum*, 1532!; Woodbush, *Grenfell in Col. Herb.*, 1105!; *Botha in Herb. Forest Dept.*, 3559!, 5286!; no collector, *in Herb. Forest Dept.*,

4974! ; Middelkop Plantation, *Keet*, 1189!. Lydenburg distr. : On farm Hebron, *Kotze in Herb. Forest Dept.*, 2835!. Pilgrims Rest distr. : Sabihoek, *Oranje*, 2! ; Lothian, *Keet*, 1130! ; Graskop, *Evans in Herb. Forest Dept.*, 5398! ; *Joubert in Herb. Forest Dept*, 8724! Barberton distr. : Wooded ravines, Rimer's Creek, 3,000 4,000 ft., *Galpin*, 451! ; *Thorncroft in Herb. Transv. Mus.*, 11174!, 2773! ; Stentor, *Munro*, P.S. 35!.

Natal Province.—Pinetown distr. : Stella Bush, near Durban, *Tyrell in Natal Herb.*, 21310! ; Amanzimtoti, *Gerstner in Natal Herb.*, 22079!. Zululand : Ngomi Forest, *Tustin in Herb. Forest Dept.*, 3555!, 3556! ; N'Kanghla Forest, *Forbes*, 766! ; Hlatikulu Forest, *Boocock*, 26! and *in Herb. Forest Dept.*, 5323!.

P.E. Africa.—Lourenco Marques, on beach, *Munro*, P.S. 166! ; Maputaland, *Maputaland Exped.*, *in Herb. Transv. Mus.*, 14351!.



B. transvaalensis Phill. and Schw.

A specimen (*Hubbard in Herb. Forest Dept.*, 3668 and *in Nat. Herb.*, 21083) collected on Meintjies Kop, Pretoria, is stated by the collector to be probably a cultivated specimen from the northern Transvaal. *Burtt Davy*, 1521, Sabie Hoek Forest, Lydenburg distr. ;

Burtt Davy, 1171, Potato Bush, Zoutpansberg distr.; *Burtt Davy*, 1413, near Pilgrim's Rest; *Burtt Davy*, 2692, Madjadjes Mountains, Zoutpansberg distr., all without flowers are probably water shoots of this species.

A large tree up to 70 ft. high and a bole up to 3 ft. in diameter but seldom sound when so large. Wood used a great deal by natives for making assegai handles. Found throughout the Ngomi Forest, Zululand, up to 4,000 ft. altitude. In the Transvaal found associated with dense forest at all elevations from 3,000 ft. upwards. Mostly a crooked much-branched tree growing along the edge of the forest but frequently inside when it makes a fine straight bole. Timber strong elastic and durable in the ground. Common name "Vaalbos"; Sesuto name is "M'pata."

[*Obermeyer*, *Schweickerdt* and *Verdoorn* 349 from the southern slopes of the Zoutpansberg is probably a female plant of the above species, but since no female specimens have been seen in the Kew Herbarium, there is some uncertainty with regard to the identity of this sheet.] The specific epithet was given by Dr. J. Hutchinson but no description published.

7. B. elliptica (Thunb.) *Less.*, Syn. Comp., 208 (1832); *Harvey*, Fl. Cap., III, 116 (1865); *Sim*, Forest Flor. C.G.H., 246 t. 92 (1907); *Wood*, Pl. Natal, 169 (1908); *Juel*, Plant. Thunb., 381 (1918); *Sim*, Native Timb. S. Afr., 44 (1921); *Bews*, Flor. Nat. and Zulul., 215, (1921); *Henkel*, Woody Pl. Nat. and Zulul., 72 (1934).

Syn.: *Tarchonanthus ellipticus* Thunb., Prodr. Pl. Cap., 145 (1794); Willd., Sp. Pl., III, iii, 1793 (1804); Pers., Syn., II, 405 (1807); Steud., Nomencl., II, 826 (1821); Thunb., Fl. Cap. ed. Schult., 638 (1823); Spreng., Syst. Veg., III, 456 (1826), excl. syn.

Brachylaena dentata DC., Prodr., V, 430 (1836), incl. syn., non Less.; Drège, Zwei Pflzgeogr.—Docum., 169 (1843).

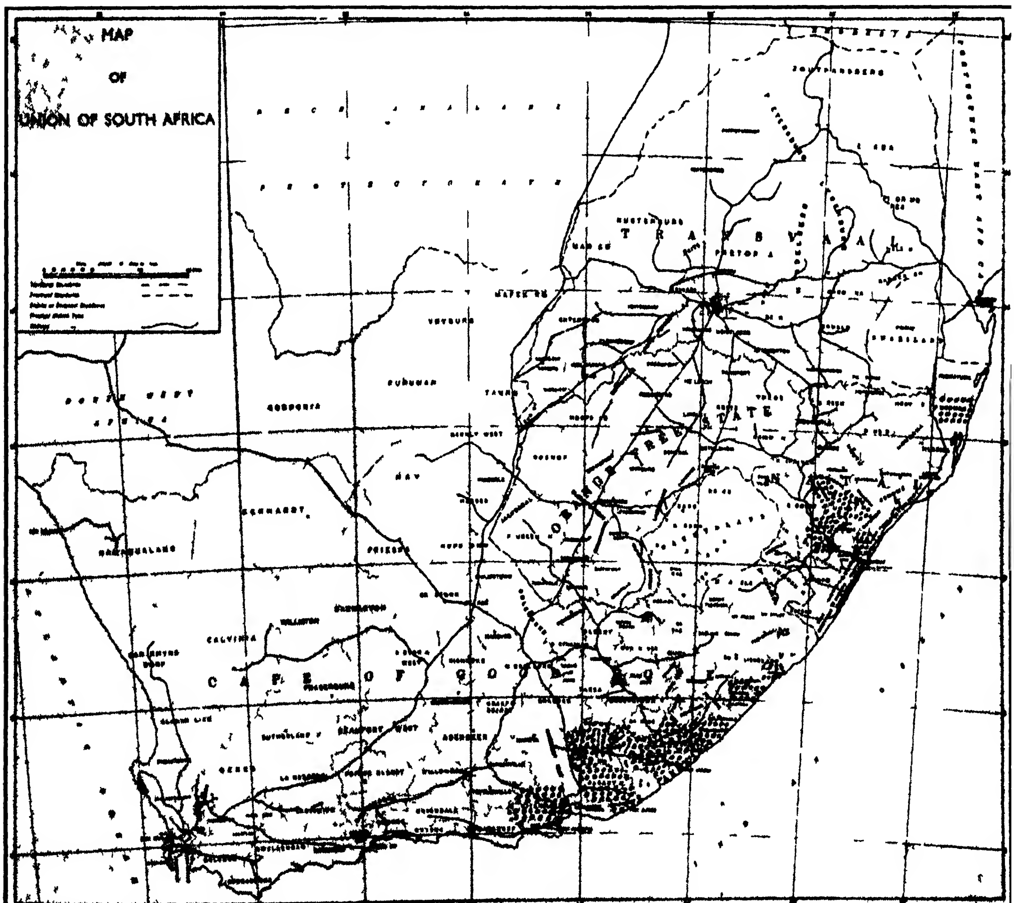
Brachylaena dentata var. *β salicina* DC., Prodr., V, 430 (1836).

Type specimen deposited in *Herb. Thunberg, Uppsala.*

Branches grooved minutely tomentulose. *Leaves* sessile or shortly petioled, 1·5-10 cm. long, 0·5–3 cm. broad, linear, linear-lanceolate, lanceolate, oblanceolate, elliptic-lanceolate or obovate, obtuse, narrowed at the base, entire or the margins somewhat serrate, toothed or irregularly lobed above, glabrous above, white tomentose beneath, with the mid-rib and lateral veins prominent or distinct. *Inflorescence* a dense terminal or axillary panicle or raceme, leafy, mostly compact but sometimes each axillary inflorescence distinct. *Male heads: Involucre* 2–5-seriate; bracts 1–3 mm. long, ovate, sometimes with membranous margins, sometimes ciliate or margins shortly lacerate. *Heads* 7–11-flowered, campanulate, about 1·5 mm. long, 1·5 mm. in diameter above. *Filaments* 0·75–1·5 mm. long, rarely 3 mm. long, linear; anthers 1–2·5 mm. long, linear, acute, tailed at the base. *Style* 3–7 mm. long, cylindric, lobes 0·5 mm. long, ovate or lanceolate, usually acuminate, acute or subacute. *Pappus* 1·75–3 mm. long, rarely 4 mm. long, usually rough, sometimes barbellate near the tips. *Female head: Involucre* 3–5-seriate; bracts 1–2 mm. long, ovate, obtuse, usually with membranous margins, usually ciliate. *Heads* 4–7-flowered, campanulate, about 2·5–3 mm. long, 2 mm. in diameter above. *Corolla-tube* 2·35–3 mm. long, cylindric, glabrous; lobes 0·5 mm. long, oblong or linear, subobtuse. *Ovary* 2·5 mm. long, glabrous or pubescent. *Achenes* 4 mm. long, obscurely angled, pubescent. *Pappus* 3–3·5 mm. long.

Cape Province.—Without locality, *Watt* and *Brandwyk*, 1808!. Uitenhage distr.; Without precise locality, *MacOwan*!; between Enon and Zuurberg Range, Hoffmanns Kloof, 1,000–2,000 ft. *Drege*!; Zuurberg Pass, 1,800 ft., *Long*, 707!. Bathurst distr.: Kowie West, on bush slopes, *Tyson in Herb. Transv. Mus.*, 1725! and *in Herb. Mus. Austro-Afric.*, 13364! and *in Govt. Herb.*, 12625! and *in Herb. Marloth*, 8876!; Bell's Beach, Kowie,

Britten, 2095! , Port Alfred, *Rogers*, 16601! Albany distr Grahamstown, *Schlechter*, 2652! and *in Herb Transv Mus* , 21396! , Broekhuizen's Poort, *South*, 670!, *Cooper*, 1563! and *in Natal Govt Herb* , 8293! , *Zeyher*, 2736! *MacOwen*, 244! and *in Natal Govt Herb* , 252!, 11005! , Brakkloof, *White*, 1172! , near Riebeek East, between Zwartwaterpoort and the Zwartwaterberg, *Burchell*, 3456! , Zwartwaterpoort, *Burchell*, 3375!, 3361!, 3400! , near Grahamstown, *Dyer*, 1340! Bedford distr Kagaberg, *Scott Elliott in Herb Galpin*, 101! Adelaide distr Without precise locality, *Marloth*, 5356! , *Watt* and *Brandwyk*, 1286! , summit Mungo Mountain, *Galpin*, 11544! Kingwilliamstown distr Evelyn Valley, Perie Mountains, *Scott Elliott*, 995! Stockenstroom distr Katberg, *Stayner*, 99! Stutterheim distr Fort Cunningham, 3,500 ft , *Sim*, 2107! East London distr East London, *Rattray*, 70! , *Watt* and *Brandwyk in Nat Herb* , 6059! , *Dowling*, 16! , *Munro in Nat Herb* , 3333! Komgha distr Near Kei mouth, *Flanagan*, 194!, 241! Kentani distr In woods near Kentani, *Pegler*, 997!, 1521! Mqanduli distr Banks of Umtata River, *Drège* Port St John's distr Between Umtata River and St John's River, *Drège*! , Pungwane Forest, *Boshoff in Herb Forest Dept* , 3474! , Mtambalala Ridge, *Fegen in Herb Forest Dept* , 3340!



B elliptica (Thunb) Less

NATAL PROVINCE.—Without precise locality, *Cooper*, 1141!. Umzinto distr.: Near Umzumbi, *Wood*, 3052! and *in Natal Govt. Herb.*, 252!; sunny slopes Ifafa Valley, *Rudatis*, 981!; Umkomaas, *Wood*, 4609! and *in Natal Govt. Herb.*, 6411!; Impambantoni Valley, *King*, 97!. Pietermaritzburg distr.: Without precise locality, *Rehmann*, 7595!; Thornybush Junction, *Marriott in Natal Herb.*, 24335!. Pinetown distr.: Near Durban, *Wood*, 10977!. Inanda distr.: Umgeni, *Wood*, 8434! and *in Natal Govt. Herb.*, 9133!; Verulam, *Wood*, 936!. Umvoti distr.: Near Greytown, *Wood in Natal Govt. Herb.*, 8893!. Weenen distr.: Hills above Weenen, *Wood*, 4445! and *in Natal Govt. Herb.*, 5160!. Lion's River distr.: Howick, *Mogg in Nat. Herb.*, 21078!. Ubombo distr.: Zululand, Mfongosi River, *Watt* and *Brandwyk*, 1014!, 1209!.

A specimen, *Zeyher* 271 labelled as from the Kat River, near Philipstown is evidently incorrect as no species of *Brachylaena* occurs so far inland.

Shrub 8 ft. high or a small tree found in the Karroid-scrub veld of the Albany district; eaten by stock (R. A. Dyer). Bush up to 15 ft. high in Natal. Native name "Isiduli-we-hlati."

According to various authors and collectors this species is a shrub or small tree up to 12 ft. high. In leaf-shape it is one of the most variable species of the genus; the floral characters, however, appear to be fairly constant throughout the wide range of material seen by the authors of this paper.

8. B. rotundata S. *Moore*, in Journ. Bot., 1903, p. 131; *Burtt Davy* and *Pott*, in Ann. Tvl. Mus., III, iii, 168 (1912); *Sim*, Native Timb. S. Afr., 44 (1921).

The type specimen is deposited in *Herb. Mus. Brit.*

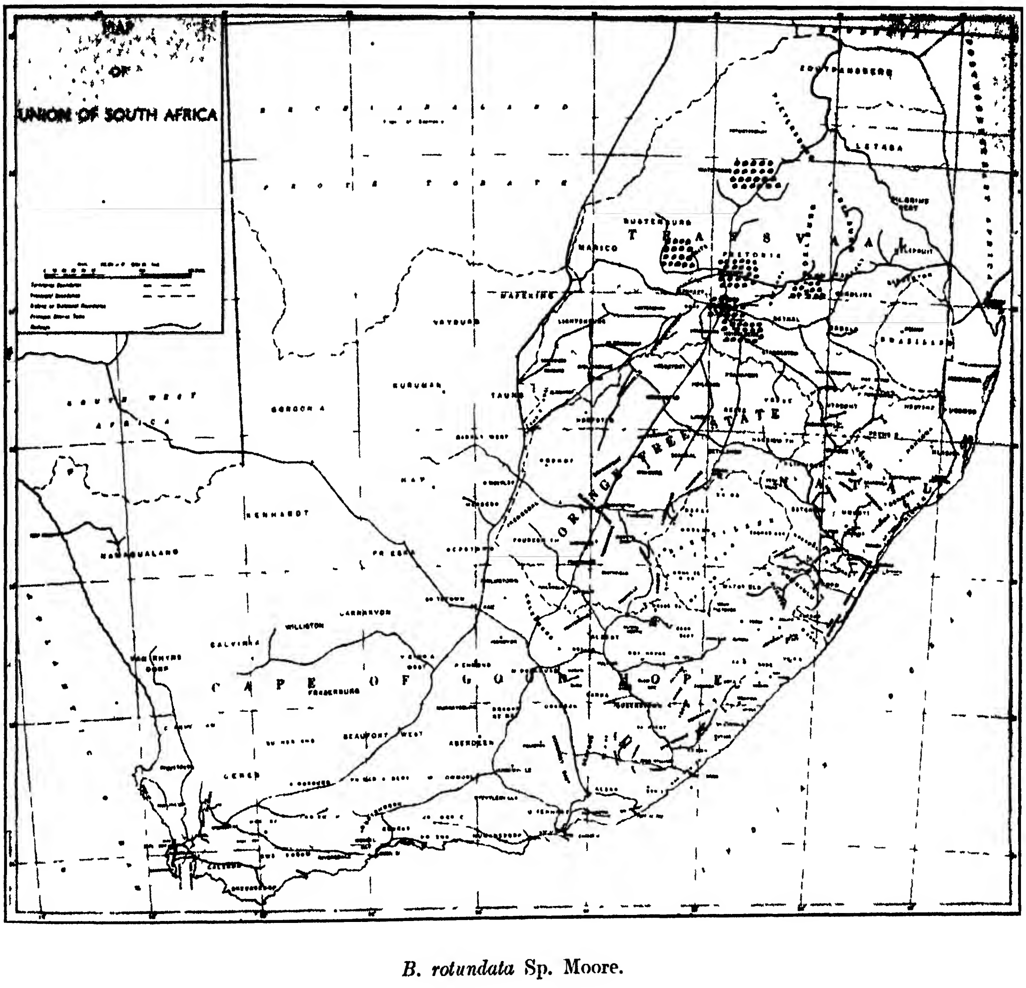
Branches grooved, shortly but densely albo-tomentose, rarely tomentulose. *Leaves* petioled or more rarely subsessile, 2·5–10 cm. long, 1-5·2 cm. broad, mostly elliptic, more rarely elliptic-lanceolate, obtuse, usually rounded at the base, more rarely slightly narrowed, with entire or irregularly-toothed margins, with the mid-rib and lateral veins prominent beneath, glabrous above, albo-tomentose beneath; petiole 5 mm. long. *Inflorescence* a dense terminal panicle with the ultimate heads sometimes cymose. *Male heads: Involucre* 4–10-seriate; bracts 1·5–5·5 mm. long; the outer ovate, obtuse, with membranous margins, sometimes shortly ciliate and glandular on the lower half; the inner ovate to linear, with membranous margins, sometimes acuminate, glabrous or glandular on the lower half. *Heads* 13–31-flowered. *Pappus* 4–5 mm. long. *Corolla-tube* 3–4·5 mm. long, cylindric, glabrous, sometimes sparsely glandular; lobes 0·5–3 mm. long, linear or lanceolate, obtuse or acute, sparsely glandular without. *Filaments* 1–3 mm. long, linear; anthers 1–3 mm. long, linear, sometimes acuminate, acute, tailed at the base. *Female heads: Involucre* 6–7-seriate; bracts 2-5 mm. long, ovate, ovate-lanceolate, linear-lanceolate to linear, obtuse, usually with membranous margins and often glandular on the lower half. *Pappus* 5–6·5 mm. long. *Corrolla-tube* 4–5·5 mm. long, cylindric, sometimes sparsely glandular; lobes 0·5–0·75 mm. long, ovate-lanceolate to lanceolate, obtuse. *Ovary* 2–4 mm. long, linear in outline, pubescent or shortly villous; style 4·5–5·5 mm. long, cylindric; lobes 0·5–1 mm. long, elliptic to lanceolate, obtuse.

TRANSVAAL PROVINCE.—Witwatersrand distr.: Jeppe's Ridge, Johannesburg, *Gilallan in Herb. Galpin*, 6018!, 6019!; near Johannesburg, *Adlam in Natal Govt. Herb.*, 7181! and *in Herb. Wood*, 5633!; Johannesburg, *Conrath*, 359!; *Gilfillan in Herb. Galpin*, 6125!; *Moss*, 2505!, 2554!, 2261!; *Rand*, 738! (type). Pretoria distr.; Pretoria, Meintjes Kop, *Pole Evans*, 474!; Pretoria Koppies, *Leendertz*, 235! and *in Herb. Transv. Mus.*, 8702! and *in Natal Govt. Herb.*, 10507!; *Rogers*, 232!; Aapies Poort, *Rehmann*, 4075!; Wonderboom Poort, *Mogg in Herb. Forest Dept.*, 1669!; Onderstepoort, *Mogg in Govt. Herb.*, 15688!; near Pretoria, *Goossens*, 81!; *Mogg*, 15165!, 15309!, 15222!, 15170!, 15088!; *Smith*, 5!; *Verdoorn*, 456!; *Repton*, 18!; *Munro in Nat. Herb.*, 3331!, 1747!; *Pole Evans*, 150!; Hartebeestpoort,

Keet, 1270!. Magaliesberg, *Leemann in Nat. Herb.*, 21116!. Heidelberg distr.: *Bonsma in Herb. Transv. Mus.*, 13139!. Rustenburg distr.: Rustenburg, *Collins in Herb. Transv. Mus.*, 11966!; *Leendertz in Herb. Transv. Mus.*, 9898!; Buffels Poort, *Turner*, 35!. Potgietersrust distr.: Potgietersrust, Pyramid Estate, *Galpin*, 8818!; near Potgietersrust, *Burtt Davy*, 2273!. Middelburg distr.: Near Mission Station, Botsabelo, on Little Olifants River, *Marloth*, 11743!, 11755!.

Also occurs in Rhodesia.

NOTE.—*Burtt Davy*, 2273 from near Potgietersrust; *Burtt Davy*, 2448 and *Mogg*, 15048 from Pretoria; *Murray*, 672 from Heidelberg probably belong to this species.



B. rotundata Sp. Moore.

9. B. discolor *DC.*, Prodr., V, 430 (1836); *Drège*, Zwei Pflzgeogr.-Docum., 155 and 157 (1843); *Harv.*, Fl. Cap., III, 117 (1865); *Wood* and *Evans*, Natal Pl., I, t. 23 and 24 (1898); *Sim*, Forest Flor. C.G.H., 247 (1907); *Wood*, Flor. Natal, 169 (1908); *Sim*, Forest Flor. Portug. E. Afr., t. 73 (1909); *Sim*, Native Timb. S. Afr., 44 (1921); *Bews*, Flor. Nat. and Zulul., 215 (1921); *Henkel*, Woody Pl. Nat. and Zulul., 72 (1934).

Syn.: *Brachylaena natalensis* Sch. Bip., in Walp. Rep., II, 972 (1843); Krauss, in Flora, 1844, p. 671; Harvey, in Fl. Cap., III, 117 (1865).

Branches grooved, minutely tomentulose or subglabrous. *Leaves* petioled, 2·5–18 cm. long (but usually 6–10 cm. long), 1–7 cm. broad, elliptic-oblong, obovate-lanceolate or oblong-lanceolate, obtuse, narrowed at the base into the petiole, entire or remotely toothed, with the mid-rib and lateral veins prominent beneath, glabrous above, white tomentose beneath; petiole about 1 cm. long, convex beneath, scarcely channelled above. *Inflorescence* an axillary or terminal raceme or panicle, with the ultimate heads sometimes cymose. *Male heads: Involucre* 5-9-seriate; bracts 1–4·5 mm. long, ovate, obtuse, ciliate, sometimes woolly; the inner ovate, lanceolate to linear, usually woolly-ciliate. *Heads* 11–50-flowered. *Corolla-tube* 3 5 mm. long, cylindric, sometimes gradually narrowing from the base upwards, glabrous; lobes 2 mm. long, lanceolate to linear, usually obtuse, sometimes subacuminate and subacute. *Filaments* 1-2·5 mm. long, linear; anthers 1·5-2·5 mm. long, linear, acute, tailed at the base. *Style* 4·5–8·5 mm. long, cylindric; lobes 0·5-1 mm. long, ovate to lanceolate, subacute. *Pappus* 4–5 mm. long. *Female heads: Involucre* 7-10-seriate. *Bracts* 3–5 mm. long, ovate, obtuse, usually woolly; the inner long and lanceolate to linear. *Heads* 11 26-flowered. *Corolla-tube* 5 7·5 mm. long, cylindric, usually widened at the base and sometimes 5-angled or with 5 veins; lobes 0·5 mm. long, ovate to linear, obtuse, more rarely subacute. *Pappus* 7 8 mm. long. *Ovary* 2·5–4·5 mm. long, linear in outline, grooved or sometimes angled, sparsely pubescent, style 6·5–10 mm. long, cylindric, swollen at the base; lobes 0·5 mm. long, ovate to linear, obtuse. *Young fruits* glabrescent.

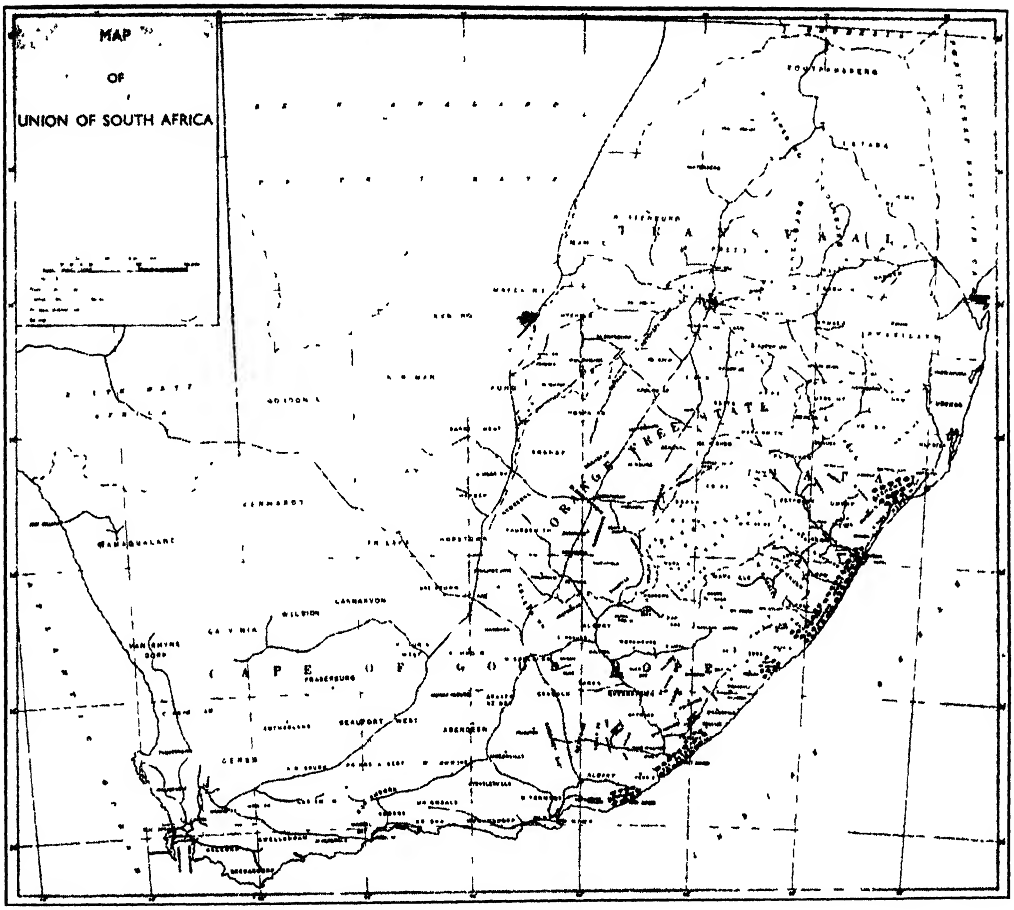
CAPE PROVINCE.—Without precise locality, *Ecklon*, 269!. Somerset East distr.: Without precise locality, *Bowker*!. Bathurst distr.: Port Alfred, *Burchell*, 2823!; *Tyson*, 54!; *Marloth*, 11998!; *Schonland*, 3304!; *Tyson in Govt. Herb.*, 12571! and *in Herb. Marloth*, 8575!; *Britten*, 773!, 1837!; at the mouth of the Great Fish River, *Burchell*, 3751!. East London distr.: East London, *Gane*, 304!; *Munro in Nat. Herb.*, 3332!. Komgha distr.: Among shrubs near Kei Mouth, *Flanagan*, 860!. Ngqeleni distr.: Bush on sand dunes, *Fegen in Herb. Forest Dept.*, 2060!. Port St. John's distr.: Port St. John's, *Doran in Herb. Forest Dept.*, 1980!. Bizana distr.: Between Umtentu and Umzimkulu River, under 500 ft., *Drège*.

NATAL PROVINCE.—Without precise locality, *Gerrard* and *McKen*, 348!, 1017! and *in Natal Govt. Herb.*, 251!, 802!; *Cooper*, 1240! and *in Natal Govt. Herb.*, 8311!. Port Shepstone distr.: Port Shepstone, Shelly Beach , *Letty*, 222!; *Burtt Davy*, 2392!. Pinetown distr.: Salisbury Island, Durban, *Forbes*, 230!; Durban, *Wood*, 5!, 4907!, 12670! and *in Herb. Transv. Mus.*, 15417!; *Krauss*, 243!; in coastal bush, *Schlechter*, 2886!; on dunes, *Rudatis*, 1089!; in dune scrub, *Moss*, 2502!, 1503!; *Marloth*, 4174!; Umbogintwini, *Salter*, 382/7!; Illovo Beach, *Hubbard in Herb. Forest Dept.*, 6103!; north end of Berea Ridge, *Galpin*, 12114!; Amanzimtoti, *Kotze*, 450! and *in Herb. Forest Dept.*, 6873!; Isipingo, *Forbes* and *Obermeyer*, 28!; *Hutchinson*, *Forbes* and *McClean*, 6!. Umzinto distr.: Without precise locality, *Rudatis*, 673!. Zululand: Dukuduku Forest, *Kotze in Herb. Forest Dept.*, 6533!; *Fair in Herb. Forest Dept.*, 8134!; northern Zululand, *Kotze in Herb. Forest Dept.*, 3516!. Mtunzini distr.: No locality, *Thode*, A1532!.

P.E. AFRICA.—Lourenco Marques, in coastal bush, *Bolus*, 1173!; *Monteiro*, 36!; *Forbes*!; *Borle*, 6!; Inyack Island, *Breyer in Herb. Transv. Mus.*, 20442!.

NOTE.—The record given by Burtt Davy and Pott (Ann. Transv. Mus., vol. 3, p. 168) is an error. It is most probably *B. rotundata* Sp. Moore.

· Common in coastal bush round Durban. At the Blue Lagoon it is grown as a hedge (Phillips).



B. discolor DC.

ACKNOWLEDGEMENTS.

The authors wish to express their gratitude to the Directors and Curators of the various herbaria for the loan of type specimens. Special thanks are due to Sir Arthur Hill, Director of the Royal Botanic Gardens, Kew, who gave the facilities afforded for this paper to be completed at the Herbarium, Kew.

AN ENUMERATION OF PLANTS COLLECTED IN THE NORTHERN TRANSVAAL.

By A. A. Obermeyer, M.Sc., H. G. Schweickerdt, Ph.D. and I. C. Verdoorn.

The following list is a classified account of the names of ferns and flowering plants collected during two excursions to the farm "Zoutpan" at the western extremity of the Zoutpansberg range. Most of the specimens were collected around the salt pan on this farm or in the vicinity of it, such as on the slopes of the mountain on the eastern margin of the pan and the sandy flats stretching to the west of it. Some of the plants listed, however, were collected on the way to and from this area or on short excursions from the pan to neighbouring places.

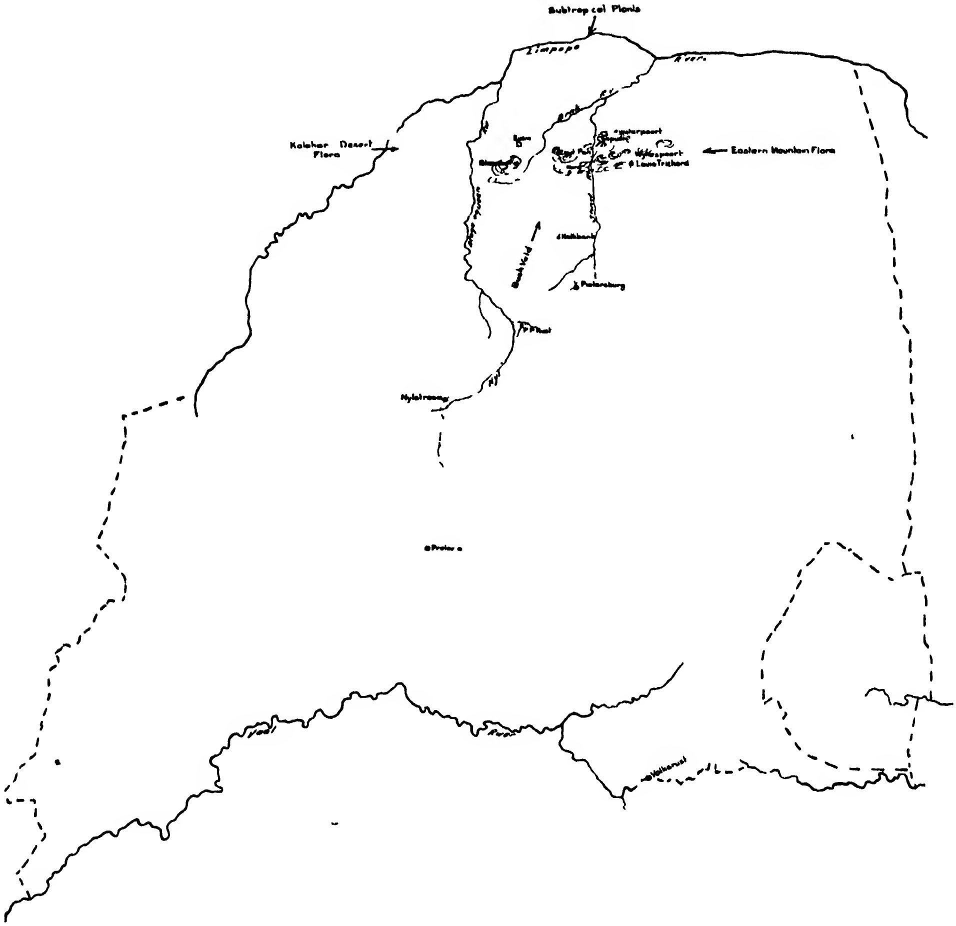
A paper by H. G. Schweickerdt [*S.A. Journal of Science*, 30, 270 (1933)] gives an account, accompanied by a map, of the vegetation of the area surrounding this salt pan. Reference should be made to it when studying this list. Further a paper by Dr. C. E. B. Bremekamp "New and otherwise Noteworthy Plants from the Northern Transvaal" [Annals of the Transvaal Museum, 15, 11 (1933)] covers more or less the same ground but includes specimens collected during a general tour.

Our first excursion was undertaken in November, 1932, when 438 specimens were collected and numbered "Obermeyer, Schweickerdt and Verdoorn 1 to 438." The route taken on this occasion was from Pretoria to Pietersburg and thence via Kalkbank and Vivo to the farm Zoutpan. Camp was pitched just behind the homestead under Lonchocarpus trees and overlooking the salt pan. During 10 days spent there two short trips were made, one westward towards the Blaauwberg to the farm Eyem and the other via Booysen's farm Chapudi to Waterpoort. Otherwise the time was spent surveying the area around the pan. The route taken on the return journey was via Wylie's Poort and Louis Trichardt.

The second excursion made in April, 1934, was undertaken by Miss Verdoorn and Dr. Schweickerdt (Miss Obermeyer being in Europe at the time). While camping at the homestead for five days, further collections were made in the same area and one short trip was made to Duvenhage's Pan near Amisfort to collect water plants. On this second excursion 252 specimens were collected and numbered "Schweickerdt and Verdoorn 440 to 691." Consecutive numbers were used for the plants collected on the two excursions to avoid confusion. The route via Louis Trichardt and Wylie's Poort was taken both going and returning.

The farm Zoutpan appears to be the meeting place of at least four distinct types of vegetation, the Eastern Mountain Flora reaching to the very margin of the pan on the east, the Kalahari-desert Flora from the west, the Bushveld from the south and the subtropical plants from the north. For this reason a botanical survey of the area seemed to hold out prospects of interesting discoveries. We consider this assumption has been justified and hope that the following list and notes of our identified plants may help future workers in the study of plant geography in Southern Africa.

The specimens were first examined at the National Herbarium and Transvaal Museum, Pretoria, by the three authors and later were sent to Kew where Dr. H. G. Schweickerdt had been temporarily transferred. There he verified or corrected the identifications and his notes on some of the specimens in this list are initialed since they were the result of research done in the absence of the collaborators.



Map to illustrate paper.

"An enumeration of plants collected in the Northern Transvaal."

The families and genera are arranged according to Della Torre and Harms and the species alphabetically. Specimens have been deposited in the National Herbarium, Pretoria, and in the Herbarium of the Transvaal Museum. Many duplicates have been donated to Kew and several to the Botanical Museum in Berlin–Dahlem and the Hofmuseum in Vienna.

The authors are grateful for the facilities granted by the Chief and the Principal Botanist of the Division of Plant Industry and the Director of the Transvaal Museum, which made this undertaking possible. We are also indebted to the Director, Royal Botanic Gardens, Kew, for the use of the herbarium and library and to several members of the staff of that Institution for assistance with the identifications; to Mr. J. Ramsbottom and staff of the British Museum and to Prof. Diels and staff of the Botanische Museum, Berlin–Dahlem, for similar help.

FILICES.

1. **Marsilia ephippiocarpa** Alston.
   Along margin of Duvenhage's Pan near Amisfort, 628.
2. **Dryopteris thelypteris** (L) A. Gray.
   In vlei at foot of mountain behind homestead, 218.

D. Pentheri (Krass.) C. Christensen; [*D. elongata* (Sw.) Sim *non* O. Kuntze.]
   Along margin of stream in kloof near homestead, 240.

MONOCOTYLEDONS.

8. APONOGETONACEAE.

1. **Aponogeton Rehmannii** Oliver.
   In semi-permanent pan on farm "Eyem," north of the Blaauwberg, 84.

A. gracilis Schinz.
   In rock-pools on first plateau of northern slopes of the mountain, 317 a. [This species was collected only once before in the Transvaal, viz. in the eastern mountain area (Houtbosch).]

A. Holubii Oliv. forma.
   Near Amisfort in Duvenhage's Pan; flowers deep yellow, 625. [This form is closely allied to, if not actually *A. Holubii* Oliv., in which the leaves are more acute and the inflorescences more robust, however, the leaves are markedly cordate in both. *A. Dinteri* Engl. and Krause, another close ally, the type of which I have seen, has narrower and more acute leaves, which are less cordate and the inflorescence is laxer than in our plant (H.G.S.).]

11. HYDROCHARITACEAE.

1. **Lagarosiphon muscoides** forma **longifolia** Wager.
   Near Amisfort in Duvenhage's Pan, 627.
2. **Ottelia ulvifolia** (Planch.) Walp. [*O. australis* Bremek., in Ann. Tvl. Mus., XV, ii 235 (1933).]
   Near Amisfort in Duvenhage's Pan, 623.

12. GRAMINEAE.

1. **Hyparrhenia Ruprechti** (Hack.) Fourn.
   At foot of northern slopes of mountain, 590.
2. **Cymbopogon excavatus** (Hochst.) Stapf
   In camp near vlei at foot of mountain, 224.

C. validus Stapf ex Burtt Davy
   In drier parts of vlei behind homestead, 587.

3. **Bothriochloa pertusa** (Willd.) A. Camus.
   In shade of *Acacia* near margin of pan, 497.
4. **Tragus Berteronianus** Schult.
   Along margin of pan, 452, 485. This species apparently is a facultative halophyte.
5. **Paspalum scrobiculatum** L. var. **Commersonii** Stapf
   In marshy soil near foot of mountain, 223.

6. **Panicum maximum** Jacq.

In kloof above waterfall, 598: in shade of trees near foot of mountain, 570: near margin of pan in shade of *Acacia*, 471. [No. 471 has shortly pubescent spikelets which are smaller in size than those of plants from Rhodesia and Tanganyika. This may be due to the young state of our material. The east African plants placed under this species in Herb. Kew are on the whole more strongly pubescent and more robust in habit. Stapf, in Fl. Trop. Afr., IX, iv, 657, considers hairiness a variable character and thus includes plants such as the above under one species (H.G.S.).]

7. **Urochloa rhodesiensis** Stent

Growing luxuriantly in shade of *Acacia* and attaining a height of 120 cm., 483.

U. panicoides Beauv.

In shade of *Acacia* along margin of pan, 464. A rather small but very leafy plant.

8. **Brachiaria deflexa** (Schum.) C. E. Hubbard ex Robyns; (*B. regularis* Stapf).

In moist places above waterfall in kloof behind homestead, 599.

B. grossa Stapf

On rocky slopes of the mountain, 525. [The spikelets are somewhat smaller and less turgid than those of typical sheets of this species (Angola). The inflorescence is less branched and on the whole our specimen is much weaker than any of the material under this species in Herb. Kew. This constitutes the first record of the species for the Transvaal (H.G.S.).]

B. nigropedata (Munro ex Hiern) Stapf

On mountain slopes behind homestead, 617.

9. **Echinochloa colona** Link

Near rocky pool on northern slopes of mountain, 618.

E. stagnina (Retz.) Beauv.

On grassy slopes near vlei behind homestead, 242.

10. **Digitaria debilis** (Desf.) Willd.

Very occasional in marshy ground, 219.

D. eriantha Steud.

On rocky ledges above kloof behind homestead, 607: on lower northern slopes of mountain, 527.

D. milanjiana Stapf

Fairly frequent in very sandy area about 3 miles west of pan, 635.

11. **Rhynchelytrum villosum** Chiov.

On lower rocky slopes of mountain, 524: in sandy area about 3 miles west of pan, 633.

12. **Tricholaena monachne** (Trin.) Stapf et Hubbard

At foot of mountain 589.

13. **Cymbosetaria sagittifolia** (A. Rich.) Schweickerdt

Fairly frequent but scattered in partial shade of *Lonchocarpus* belt, 578. [This constitutes the first record for the Transvaal. So far it has been recorded from Tropical Africa only, including northern South West Africa.]

14. **Setaria verticillata** (L.) Beauv.

Along margin of pan, growing in association with *Heliotropium*, 466. Our gathering is somewhat stunted, undoubtedly due to abnormal edaphic conditions.

15. **Cenchrus ciliaris** L.

Frequent but scattered in *Catophrates* belt, apparently grazed by stock, 179: about 3 miles west of pan in very sandy soil, fairly frequent, 632.

16. **Aristida adscensionis** L.

In shade of *Acacia* near margin of pan, 472.

A. meridionalis Henr.

Very occasional between loose boulders on northern slopes of mountain, 604.

A. junciformis T. and R.

On grassy slopes east of pan, at foot of mountain, 572.

A. barbicollis T. and R.

On margin of pan, only one specimen found, 461.

A. uniplumis Licht.

Dominant in very sandy soil about 3 miles west of pan, 630.

17. **Sporobolus panicoides** Rich.

In shade of bushes at Wylie's Poort, 672.

S. pyramidalis Beauv.

In upper drier regions of vlei behind homestead, fairly frequent, 585: in *Lonchocarpus* belt, 500.

S. Smutsii Stent

A fairly frequent markedly stoloniferous species near the margin of pan, 460: in shade of bushes near margin of pan, 469.

18. **Danthoniopsis Dinteri** (Pilger) C. E. Hubbard (*Trichopteryx Dinteri* Pilger).

Fairly frequent on lower rocky slopes of mountain, 522. The tropical African specimens of this species in Herb. Kew are generally much more robust than our gathering.

19. **Loudetia filifolia** Schweickerdt

On lower rocky slopes of the mountain, subdominant, 523.

20. **Cynodon dactylon** (L.) Pers.

In shade of species of *Acacia* at foot of mountain, leaves distichous, 588: frequent near vlei below mountain, 228.

21. **Chloris virgata** Sw.

In shade of species of *Acacia* near margin of pan, 484.

22. **Dactyloctenium aegyptium** (L.) Beauv.

Occasional near margin of pan, 457: in shade of species of *Acacia* near margin of pan, 490. [No. 490 differs from typical *D. aegyptium* in being a taller plant and an annual, but a large range of flowering and fruiting material will be necessary before it will be possible to say whether more than one species of this genus occurs in South Africa (H.G.S.).]

23. **Enneapogon cenchroides** (Licht.) Hubbard

Fairly frequent on rocky ledges above kloof behind homestead, 608: in shade of species of *Acacia* near margin of pan, 489, 538, 478.

E. Pretoriensis Stent

Fairly frequent on northern rocky slopes of the mountain, 605.

24. **Schmidtia bulbosa** Stapf forma ?

Among loose stones on northern slopes, 569, 606: in very sandy area about 3 miles west of pan, 631. [Our plants differ somewhat from typical *S. bulbosa*. No. 631 differs

particularly in the relatively short awns which only just exceed the membranous lobes of the lemma and the palea being broader and more obovate. The glumes in all three specimens are 9–10-nerved whereas in true *S. bulbosa* they are 7-nerved (H.G.S.).]

This grass is locally known by the vernacular name "krulgras" on account of the very curly appearance of the old withered leaves.

25. **Phragmites communis** Trin.

In marshy soil east of pan along margin of periodic stream, 621.

26. **Trichoneura Schlechteri** Ekman (*Triodia Schlechteri* Pilger, nomen !).

On rocky ledge above kloof behind homestead, 609 : among loose stones on northern slopes of mountain, 526.

These specimens are very similar to *Moisier* 135 from northern Nigeria in Herb. Kew, only differing in being somewhat less hairy. Furthermore they differ from typical *T. Schlechteri* by being annual and having narrower leaf-blades (H.G.S.).]

27. **Odyssea paucinervis** (Nees) Stapf

Along margin of pan, 453, 463, 498, 499. This species is dominant along the margin of the pan. It is a typical halophyte and forms a dense sward surrounding the greater part of the pan. The spikelets are very variable with regard to the number of florets. No. 499 has up to 20-flowered spikelets. The leaves are rigid and pungent.

28. **Eragrostis cilianensis** Link

In shade of species of *Acacia*, east of pan, 540.

E. aspera (Jacq.) Nees

In Wylie's Poort in shade at foot of rocky ledges, 449.

E. curvula Nees

In very deep sandy soil about 3 miles west of pan, 629.

E. chloromelas Steud.

In drier parts of vlei west of homestead, 586.

E. gummiflua Nees

On grassy slopes at foot of mountain, east of pan, 573, 574.

13. CYPERACEAE.

1. **Cyperus sexangularis** Nees

Eastern margin of pan under small *Acacia*, 287.

2. **Pycreus lanceus** (Thunb.) Turrill

Frequent in vlei behind homestead, 196.

P. polystachyus Beauv.

Occasional in vlei behind homestead, 211.

3. **Mariscus dregeanus** Kunth

Along margin of stream leading from vlei behind homestead, 241.

4. **Kyllinga melanosperma** Nees

Frequent in vlei behind homestead, 212, 197. No. 212 appears to be a somewhat dwarfed specimen, but otherwise agrees in essential characters with this species.

5. **Fuirena chlorocarpa** Ridley

Occasional in vlei behind homestead, 210.

6. **Scirpus muricinux** C.B. Cl.

Frequent in semi-permanent pan on farm "Eyem," north of the Blaauwberg, growing in association with *Marsilia ephippiocarpa* and *Aponogeton Rehmannii*, 82.

7. **Fimbristylis complanata** Link

Frequent in vlei behind homestead, 199.

F. diphylla Vahl.

In vlei behind homestead, 221.

20. XYRIDACEAE.

1. **Xyris capensis** Thunb.

Occasional in vlei behind homestead, 198.

22. COMMELINACEAE.

1. **Commelina Forskalaei** Vahl.

East of pan under cover of *Acacia*; flowers blue, 533. The capsules of this specimen are constantly 1-seeded.

24. JUNCACEAE.

1. **Juncus lomatophyllus** Spreng.

Very frequent in vlei behind homestead, 208.

25. LILIACEAE.

1. **Anthericum elongatum** Willd. var. **holostachyun** Bak.

On southern slopes of mountain about 6 miles west of Louis Trichardt, 343.

2. **Aloe rubro-lutea** Schinz

Between Waterpoort and Zoutpan, 451a: farm "Stafford," north of Blaauwberg, very frequent in open grassland, 647.

Typical plants from S.W. Africa have more densely bracteate inflorescences and appear to flower in December. Our specimens do not differ sufficiently to warrant the creation of a separate species.

3. **Albuca sp.**

Occasional on stony east fringe of the pan, 139. This is probably an undescribed species.

4. **Urginea Langii** Bremekamp

Farm "Kromhoek," north of Blaauwberg; flowers white with greenish keel, gregarious, 80.

This species is fairly frequent in sandy areas in the vicinity of the Zoutpan. Whether it is correctly placed in the genus *Urginea* is somewhat doubtful. In appearance it resembles an *Albuca* more closely and is apparently allied to *Albuca hereroensis* Bak. (Schinz 2 in Herb. Kew !). It differs from this in the shorter pedicels and smaller flowers. Fruiting material, however, is necessary to decide its true affinity. (The species has recently been collected at Rust-der-Winter, Pretoria district, by Dr. I. B. Pole Evans.)

5. **Dipcadi glaucum** (Burch.) Baker

Occasionally gregarious near margin of pan, 29, 259.

D. sp.

Between Zoutpan and Waterpoort, numerous plants in patches; flowers greenish, 268. This is probably an undescribed species.

6. **Scilla megaphylla** Baker

Frequent in shade above rocky ledges near waterfall on farm "Elsteg," about 6 miles west of Louis Trichardt, 367.

7. **Asparagus exuvialis** Burch.

In open patches of *Acacia* belt, on north side of pan, 51: farm "Eyem," north of Blaauwberg, 97.

A. sp.

Creeping in species of *Acacia* on fringe of pan; stems pubescent; fruits small, green, globose, 141.

27. AMARYLLIDACEAE.

8. **Crinum buphanoides** Baker

Farm "Eyem," north of Blaauwberg, 86. This is a gregarious species commonly met with in deep sandy soil. The perianth varies in colour from whitish to dark pink; the tube is 10 cm. long, very narrow and greenish in colour while the segments are only about 5 cm. long and spread abruptly.

28. VELLOZIACEAE.

1. **Vellozia equisetoides** Baker.

On northern slopes of mountain, 318. This plant has branched stems reaching a height of 1 metre. It was the first record of the species for the Transvaal Province but has since been collected in Sekukuniland.

29. DIOSCOREACEAE.

1. **Dioscorea cotinifolia** Kunth (*D. malifolia* Bak.).

Liane in bush above waterfall on farm "Elsteg," about 6 miles west of Louis Trichardt, 360.

DICOTYLEDONS.

36. SALICACEAE.

1. **Salix Wilmsii** Seem.

A tree, about 8 metres high, with slender branches; very frequent along stream in Wylie's Poort, 442.

38. ULMACEAE.

1. **Trema guineensis** (Schum.) Ficalho

On slopes of mountain of farm "Elsteg," about 6 miles west of Louis Trichardt, 350.

39. MORACEAE.

1. **Ficus capensis** Thunb.

In kloof behind homestead; fruit borne on branches at foot of tree, 598a.

F. Pretoriae Burtt Davy

On rocky ledge at top end of kloof behind homestead, 614, 281; near foot of mountain; small shrubby tree, 104.

F. Smutsii Verdoorn

On lower rocky slopes of mountain, 600.

F. soldanella Miq.

Northern rocky slopes behind homestead, 280: at foot of mountain, east of pan, 571. The fruits of 571 are about 1.5 cm. in diam. and thus larger than usual.

F. Sonderi Miq.

On northern rocky slopes of pan, 230: east of pan, 560: on rocky slopes along roadside in Wylie's Poort, 669.

No. 230 was a very tall umbrageous tree with a canopy about 30 metres in diameter and with conspicuously whitish to light brown stem and branches. The branches arch downward and touch the ground, but were not found to root as in *F. Pretoriae.*

F. sycomorus L.

At foot of mountain; fruit with felty pubescence, 593.

F. sycomorus L. **forma** ?

Along stream leading from kloof to homestead, 110. This specimen resembles *F. sycomorus* closely but differs in having larger and almost glabrous fruits. It may represent an undescribed species and requires further study in the field.

40. URTICACEAE.

1. **Pouzolzia hypoleuca** Wedd.

Frequent along streams in Wylie's Poort, 337.

42. LORANTHACEAE.

1. **Loranthus Breyeri** Bremekamp

North side of pan; parasitic on *Acacia sp.*, flowers yellowish, 52. This species is evidently of limited geographic range.

L. Dregei E. and Z. var.

Parasitic on species of *Acacia*, north of pan; flowers yellow and green, 47: on species of *Ptaeroxylon* behind homestead, 17.

L. kalachariensis Schinz

At foot of mountain behind homestead, 517. The clusters of bright red flowers are very striking.

L. oleaefolius var. **Leendertziae** Sprague

Parasitic on malvaceous shrub on northern slopes of mountain; flowers brownish-red with the reflexed petals green within, 282.

2. **Viscum combreticola** Engl.

Parasitic on *Pseudolachnostylis sp.*, on northern slopes of mountain, 311: on *Combretum sp.* on northern slopes of mountain, 166.

V. verrucosum Harv.

Parasitic on *Acacia sp.*, near margin of pan; fruit stippled, 492.

45. OLACACEAE.

1. **Olax dissitiflora** Oliv.

Very frequent on northern slopes of mountain, 153, 236.

2. **Ximenia americana** var. **microphylla** Welw. ex Oliver (*X. Rogersii* Burtt Davy).

Very frequent at foot of mountain behind homestead, 530, 111.

X. caffra Sond.

Near margin of pan, 295 : at foot of mountain in association with *Dichrostachys sp.*, 5.

50. POLYGONACEAE.

1. **Polygonum lapathifolium** var. **glabrum** Burtt Davy

Hydrophyte, in association with *Nymphaea*, *Ottelia*, etc. in Duvenhage's pan near Amisfort, 626.

Burtt Davy in Flora of Transvaal, I, p. 169, states that this variety has glabrous peduncles. The specimen collected by Holub, however, cited under this variety, shows the presence of scattered glands on the peduncles.

P. serrulatum Lag.

In vlei behind homestead ; flowers whitish to heather pink ; bracts pink, 215.

51. CHENOPODIACEAE.

1. **Chenopodium ambrosoides** L.

Margin of pan, occasional, 456.

2. **Suaeda fructicosa** Forsk.

Along margin of pan, 38, 462. This characteristic halophyte together with *Odyssea paucinervis* is one of the dominant species surrounding the pan.

52. AMARANTACEAE.

1. **Celosia scabra** (Schinz) (*Hermbstaedtia scabra* Schinz).

In shade of *Acacia* near margin of pan ; flowers pink, 481. [This species formerly placed under *Hermbstaedtia* by Schinz has now been transferred to *Celosia* on the grounds that the anthers are inserted on the lobes between the sinuses of the staminal-tube (see Engl. Pflanzenfam., ed. II, 16c (1934). Schinz has furthermore placed *H. linearis* under this genus and following him *H. Rogersii* Burtt Davy should also be transferred to *Celosia* (H.G.S.).]

2. **Cyathula crispa** Schinz

In Acacia belt north of pan, 46 : occasional near *Catophractes* belt, 505.

C. uncinulata (Schrad.) Schinz (*C. globulifera* Moq.).

Along margin of pan, 496.

3. **Pupalia lappacea** (L.) Juss.

Near stream in vlei behind homestead, 238.

4. **Alternanthera repens** (L.) O. Ktze.

In open ground east of pan, 548.

A. sessilis (L.) R. Br.

In stream leading from vlei behind homestead, 207.

53. NYCTAGINACEAE.

1. **Commicarpus plumbagineus** (Cav.) Standley. (*Boerhaavia plumbaginea* Cav.).

Growing under cover of shrubs near margin of pan ; herb 3 ft. high ; flowers white to pale mauve ; stamens 2, pink, long, exserted, 19, 451.

C. fallacissimus (Heim.) Heim. forma **pilosa** Heim. differt a typico *C. fallacissimo*: indumento subdenso, pilis scabridulis, brevissimus petulis formato, verticillis summofere 6-floris, florum (pulchre purpureorum) pedicellis valde brevibus, usque solum 2.5 mm. long., haud capillaribus.

Frequent in sandy soil, growing in association with *Tribulus Zeyheri* Sond., near Vivo; flowers pink; stamens long exserted; fruits glandular, 653 (type): on northern slopes of mountain behind homestead, 103.

The description of this new form was sent by Dr. Anton Heimerl of Vienna. In the letter he states:

"In den Abhandl. Bot. Ver. Prov. Brandenb. XXXI, 223 (1890) habe ich die der *Boerhaavia verticillata* Poir nahestehende *B. fallacissima* (eine ebenfalls bistaminate Art) beschrieben, die jetzt in die durch Standley abetrennte Gattung *Commicarpus* Standley (Contrib. U.S. Nat. Herb.) XII, 373 (1908) einzureihen ist. Von diesem *Commicarpus fallacissimus* Heim., den ich aus Arabien (Aden) vom Somaligebiete und aus dem Hererolande kenne, unterscheidet sich die (im schönsten Blühen aufgesammelte) Nr. 653 durch das rauhe, ziemlich dichte, ganz kurze Haarkleid, durch die höchstens 6-blütige quirle und durch sehr kurze, bis 2.5 mm. lange, nicht haardünne Blütenstiele. Der Arttypus ist fast kahl, die Quirle sind bis 8-blütig und die ganz dünnen Blütenstiele erreichen schon zur Anthese 5–17 mm. an Länge; veilleicht würden reife Anthocarpen (sie fehlen Nr. 653) auch Unterschiede bieten. Ich möchte daher die Transvaal-pflanze als eine bemerkenswerte Form abtrennen und sie als f. *pilosa* anführen."

2. **Boerhaavia diffusa** L.

In open veld east of pan, forming tussocks; flowers small, purplish-pink, 551. With regard to this gathering Heimerl remarks as follows:—

"Wenn ich die *Boerhaavia* einfach als *B. diffusa* L. bezeichne, glaube ich, keinen argen Verstoss zu begehen; in den Formenkreis dieser weitverbreiteten und sehr formenreichen Art gehört sie sicher, ebenso wie die von mir vor, langer zeit aufgestellte *B. Schinzii*, die freilich durch einige Merkmale aus der Formenmenge vorragt; das Fehlen von Anthocarpen macht die Sache natürlich auch schwieriger!"

54. PHYTOLACCACEAE.

1. **Limeum Meyeri** Fenzl.

Frequent in very sandy area about 3 miles west of pan; flowers white, 639.

L. Dinteri Schell.

Between Waterpoort and Zoutpan, 264.

[In foliage and habit this gathering is a good match of *Dinter* 998 and *Lüderitz* 161 in Herb. Hort. Bot. Berol. The inflorescence in our specimen, however, is more compact and abbreviated, but this difference alone does not warrant its exclusion from the above species (H.G.S.).]

2. **Semonvillea fenestrata** Fenzl.

Very sandy aréa about 3 miles west of pan, 636.

3. **Gisekia pharnaceoides** L.

Very frequent in sandy area near Vivo; petals purple-pink, 654: east of pan; petals pink-tipped; stamens white, 545.

55. AIZOACEAE.

1. **Mollugo nudicaulis** Lam.

In shade of trees south-east of pan, 584.

M. Cerviana (L.) Ser.

Frequent in open spaces among *Acacia* trees near margin of pan, 532.

2. **Pharnaceum salsoloides** Burch. (*P. verrucosum* E. and Z.).

In sandy soil on eastern margin of pan; flowers white, 298: in shade of *Acacia* trees east of pan, 534.

3. **Orygia decumbens** Forsk.

In open sandy soil between Zoutpan and Waterpoort, not very frequent, 269.

4. **Trianthema pentandra** L.

Very frequent along eastern margin of pan, 546.

T. erectum Schlechter

Along margin of pan; flowers very small in sessile clusters; perianth-segments 5, white; stamens 5 with pink anthers, 459.

[In Herb. Hort. Bot. Berol. four sheets of *Schlechter* 11790 (from Komatipoort, Tvl.) are not unlike our plant. The specimens, however, were collected in a young and sterile stage. In foliage and branching they agree with our plant, but appear to be of an upright habit—in fact they closely resemble the right-hand specimen of our 459 *in Nat. Herb. Pretoria*—whereas the remaining specimen on this sheet has a semi-prostrate habit (H.G.S.).]

5. **Sesuvium digynum** Welv. ex Oliver (*Trianthema salarium* Bremekamp).

Western side of pan, *Bremek.* and *Schweickerdt*, 232; under *Acacia* shrubs near margin of pan; flowers sessile purple-pink; stamens 9; styles 2, 488.

56. PORTULACACEAE.

1. **Talinum Arnotii** Hook. f.

Common in sandy soil between Zoutpan and Waterpoort, 260.

T. caffrum (Thunb.) E. and Z.

Fairly frequent in sandy soil on farm "Eyem," north of Blaauwberg, 93.

T. transvaalensis von Poellnitz

In cover of shrubs in *Catophractes* belt, 193.

2. **Portulacaria afra** Jacq.

In Wylie's Poort, decumbent on rocks or arborescent, up to 5 metres high, 332.

P. oleracea L.

Occasional along margin of pan; flowers yellow, 31.

P. quadrifida L.

Fairly frequent on eastern side of pan, 294.

P. trianthemoides Bremekamp

Frequent along margin of pan; flowers deep yellow, 458.

59. NYMPHAEACEAE.

1. **Nymphaea caerulea** Sav.

In Nyl River about seven miles north of Nylstroom; flowers white with yellow centre, 440.

N. capensis Thunb.

Near Amisfort in Duvenhage's Pan; flowers blue with yellow centres, 624.

The flower-stalk of these specimens is always exserted from 15–30 cm. beyond the surface of the water, whereas in the foregoing species the flower almost floats on the surface of the water.

62. MENISPERMACEAE.

1. **Cocculus hirsutus** (L.) Diels

Liane, common on trees in *Lonchocarpus* belt, 284.

2. **Desmonema caffrum** Miers.

Liane, frequent in *Lonchocarpus* belt; berries scarlet, 136.

This plant was observed to reach the tops of fairly tall trees such as *Albizzia*, etc. The stems are extremely succulent and very brittle. This is the first record of the species for the Transvaal.

63. ANNONACEAE.

1. **Hexalobus glabrescens** Hutch. and Dalz.

Small spreading tree on upper slopes of mountain, 155, 315.

2. **Artabotrys brachypetalus** Benth.

Tree about 2 metres high, on upper slopes of mountain, 321, 160.

70. CAPPARIDACEAE.

1. **Cleome diandra** Burch. (*Dianthera Petersiana* Klotszch; *D. burchelliana* Klotszch).

On ledge on slopes of mountain; flowers yellow, 612.

2. **Capparis tomentosa** Lam.

In *Lonchocarpus* belt near margin of pan, 13. A robust sprawler with festooning branches inclined to cover completely smaller trees and shrubs such as *Acacia* and *Salvadora*.

3. **Boscia Rehmanniana** Pest. forma.

In *Catophractes* belt, leaves and fruit shortly pubescent, 182a.

[This tree is fairly frequent in the sandy area north of the pan where it reaches a height of 4–5 metres. It differs from typical *B. Rehmanniana* in having pubescent leaves, whereas in the latter species they are always glabrous. *Lugard* 27 from Kwebe Hills, Ngamiland in Herb. Kew, resembles our gathering, but has glabrous leaves. The fruits, however, are pubescent and the flowers fasciculate (not a pedunculate inflorescence !) in which points it agrees with our gathering. Furthermore our specimen agrees in habit and in fruit with *Seiner* 78 from Bechuanaland in Herb. Hort. Bot. Berol. but in this specimen also the leaves are glabrous (H.G.S.).]

B. albitrunca Gilg et Benedict.

Between Zoutpan and Waterpoort, 276.

4. **Courbonia glauca** (Kl.) Gilg and Benedict (*C. camporum* Gilg and Benedict).

Between Waterpoort and Wylie's Poort, 328; between Zoutpan and Waterpoort, 247.

[Gilg and Benedict in Engl. Bot. Jahrb., 53, 217 (1915) distinguish between *C. glauca* and *C. camporum* on the grounds that the former is a woody shrub, whereas the latter is a herbaceous plant. Knowing our plant well in the field, these characters in my opinion are of no taxonomic value. *C. glauca* may either be a herbaceous plant 25 cm. or so high, or may reach a height of nearly 3 metres. It then is a shrub with a fairly lignified base. I have compared our gatherings with the types of *C. glauca* and *C. camporum* and have come to the conclusion that only one species is concerned (H.G.S.).]

5. **Cadaba termitaria** N. E. Br. (*C. macropoda* Gilg).

Very occasional near margin of pan, 34, 286.

[The shape and size of the leaves of this species is variable, a character of many plants growing in arid regions. Our specimens have much smaller leaves than the type of *C. termitaria*, but this difference alone does not justify specific distinction. Several small-leaved specimens in Herb. Kew were considered by Dr. J. Burtt Davy to represent a distinct species, but in my opinion are merely forms of the above species (H.G.S.).]

6. **Maerua maschonica** Gilg

North of pan, 2.5–3 m. high, scrambling in *Salvadora sp.*, 43. Cattle are very fond of this plant.

M. Legatii Burtt Davy

Shrub about 1 m. high in *Catophravtes* belt, north of pan, 182.

76. CRASSULACEAE.

1. **Kalanchoe paniculata** Harv.

East side of pan at foot of mountain; flowers, yellow-green; leaves crenate, 561; scattered in *Catophractes* belt, north of pan, 184.

[The following described species are very closely allied: *K. paniculata* Harv., *K. multiflora* Schinz, and *K. pyramidalis* Schönl. In the descriptions they are distinguished by having either entire or crenate, sessile or petiolate leaves. Whether those characters are of taxonomic value is doubtful, since in our 561 both sessile and petiolate leaves are found on the same plant. There are a few sheets in Herb. Kew from Ngamiland and Rhodesia named by N. E. Brown as *K. multiflora* Schinz. Those specimens have crenate leaves, whereas Schinz describes the species as having entire leaves. It is somewhat doubtful whether the three species mentioned above, differing in leaf-shape only, a variable character in many succulents, should occur in the same geographic region. Study of plants in the field will probably show that the above view is correct (H.G.S.).]

77. SAXIFRAGACEAE.

1. **Vahlia capensis** Thunb.

In shade of shrubs above vlei behind homestead, 232a.

80. MYROTHAMNACEAE.

1. **Myrothamnus flabellifolia** (Sond.) Welw.

On northern rocky slopes of mountain, 615, 616, 171. This plant is perhaps one of the most remarkable found in Southern Africa. It is a dioecious shrub reaching a height of about 75 cm. and is usually gregarious. The male and female plants grow side by side. Some branches are decumbent and root adventitiously. Fragments of the plant which are shrivelled and dead will resurrect even after many years when soaked in water and assume colour and habit as in the living state (probably an imbibition movement).

85. LEGUMINOSAE.

1. **Albizzia Rogersii** Burtt Davy

On rocky northern slopes of mountain, 170, 601; a tall tree with markedly spreading branches, locally fairly abundant.

2. **Acacia Benthamii** Rochebr.

In *Lonchocarpus* belt close to pan, 9; small tree, only about 1.5–2 metres high, on the very margin of pan, 470.

A. heteracantha Burch. (*A. litakunensis* Burch.; *A. spirocarpoides* Engl.).

Between Zoutpan and Waterpoort, 274: along eastern margin of pan, 150.

A. karroo Hayne

Frequent in *Lonchocarpus* belt between foot of mountain and pan, 11.

A. pennata Willd.

Above stream leading from the kloof behind homestead, 108.

A. permixta Burtt Davy var. **glabra** Burtt Davy

North side of pan forming dense patches, 41, 60. Plants reaching a height of 1–2 metres and forming dense scrub adjoining the halophytic fringe flora of the pan.

A. Senegal Willd. (*A. rostrata* Sim).

East side of pan, 300. Only a few specimens of this low-spreading tree about 5 metres high were found scattered along the eastern margin of the pan.

A. Woodii Burtt Davy

In *Lonchocarpus* belt, 12. Large round-topped trees with rough bark and clustered branches, growing among *A. karroo*.

3. **Dichrostachys glomerata** (Forsk.) Hutch. and Dalz.

On northern slopes of mountain, 226.

4. **Elephantorrhiza Burkei** Benth.

In depression on northern slopes of mountain: small shrubs, occasional, fruiting specimens only, 175.

5. **Burkea africana** Hook.

On upper slopes of mountain, flat-topped trees, 319.

6. **Copaifera mopane** Kirk

Between Waterpoort and Wylie's Poort, 329.

7. **Cassia delagoensis** Harv.

Fairly frequent at foot of mountain east of pan, 563.

C. arachoides Burch. forma ?

Frequent in sandy soil, between Zoutpan and Waterpoort, 265: fairly frequent in very sandy area about 3 miles west of pan, 642.

[Our specimens match *Moss* and *Rogers* 36 from Messina, N. Transvaal, placed under *C. holosericea* Fresen. by Burtt Davy in his Flora of the Transvaal, ii, 325 (1932). The flowers and fruits of true *C. holosericea* are much smaller and more hairy than those of our 265 and 642. *C. obovata* Collad. has fruits which differ by the conspicuous median crest on the lateral surfaces. Our plants are most closely allied to *C. arachoides* Burch. of which species they may be merely a pubescent form (H.G.S.).]

8. **Pterolobium exosum** (Gml.) Bak. f. (*P. lacerans* R. Br.).

Frequent in Wylie's Poort, 450. A conspicuous liane on account of its showy brilliant-red winged fruits, climbing to the tops of the highest trees in the forest-clad ravines.

9. **Peltophorum africanum** Sond.

Frequent on lower slopes of mountain; tree with erect racemes of bright yellow flowers, 107.

10. **Pseudocadia zambesiaca** (Bak.) Harms

At foot of mountain east of pan, 596: north-western slopes of mountain, 65. Frequent in area around pan; one of the tallest and most umbrageous trees with dark shiny foliage and stems up to 2 metres in diameter.

11. **Calpurnia subdecandra** (L'Herit.) Schweickerdt comb. nov.: [*Robinia subdecandra* L'Herit. in Stirp., Nov., 157, t. 75 (1784); *Calpurnia lasiogyne* E. Mey].

Farm "Elsteg," about 6 miles west of Louis Trichardt, 353.

12. **Lotononis Bainesii** Bak.

Frequent along furrow leading from large vlei west of homestead, 235.

13. **Crotalaria Schinzii** Bak. f.

Frequent in shade of trees at foot of mountain, south-east of pan, 580.

C. longistyla Bak. f.

Between Louis Trichardt and Pietersburg, frequent in sandy soil, 664.

C. inhabilis Verdoorn sp. nov.

Affinis **C. australi** *sed pubescentia appressa et ovario tomentosa differt*, *affinis* **C. athroophyllae** *sed racemis laxioribus elongatioribusque, calyce breviore, floribus omnino flavis* (*nec purpureo-striatis*), *et suffrutice circiter* 1 *m. alto differt.*

Suffrutex erectus, ± 1 m. altus, supra ramosissimus; ramuli petioli et penduncoli breviter griseo-appresso-pubescentes. *Folia* exstipulata, longe-petiolata, trifoliolata; petioli 6 cm. longi, internodiis et foliolis valde excedentes; foliola lineares vel anguste-oblonga, 1–3 cm. longa, 2–7 mm. lata, infra appresse pubescentes, supra glabrescentes, apice minute mucronata vel retusa, basi leviter cuneata, breviter petiolulata. *Racemi* oppositifolii vel terminales, elongati, 15–23 cm. longi, laxi, 10–15-flori. *Bracteae* subulatae, 2 mm. longae. *Flores* flavi, ± 2 cm. longi, in medio racemorum plerumque 2 cm. distantes (*C. athroophyllae* 1 cm. distantes). *Pedicelli* circiter 10 mm. longi, breviter appresse griseo-pubescentes, infra medium 2-bracteolati. *Calyx* ± 8 mm. longus, appresse pubescens vel glabrescens, lobis deltoideis circiter 3 mm. longis. *Vexillum* dorso glabrum; carina dorso rotundata, 2 cm. longa, 7 mm. lata. *Ovarium* longe-stipitata, argenteo-tomentosa.

Transvaal.—Zoutpansberg distr.: On sandstone outcrop about 10 miles east of Waterpoort, Nov., *Obermeyer*, *Schweickerdt* and *Verdoorn*, 323.

C. inhabilis was found abundantly on a sandstone outcrop about 10 miles east of Waterpoort on the road to Wylie's Poort. It is an erect half-shrub up to about 4 ft. high and is densely branched above, which gives it a top-heavy or broom-like appearance. The clustered ultimate branchlets, which are much more slender than those from which they arise, and the very long-petioled leaves, the petioles being about three times as long as the leaflets, accentuate the broom-like appearance. The pure yellow flowers are borne on the branchlets in lax elongated racemes which may be either terminal or opposite the leaves.

14. **Argyrolobium transvaalense** Schinz

Fairly frequent on farm "Elsteg," about 6 miles west of Louis Trichardt, 351.

15. **Indigofera circinnata** Benth.

Between Zoutpan and Waterpoort, 275. A spiny slender shrub reaching a height of about 1 metre.

I. egens N. E. Br.

On upper slopes of mountain, 307.

I. flavicans Bak.

Frequent in sandy area east of pan, 296, 549.

I. Holubii N.E. Br.

Growing in cover and shade of bushes; flowers attractive, rosy pink or red, 480: east of pan, 544.

I. tettensis Klotzsch (*I. Baukeana* Vatke).

In shade of bushes along margin of pan; flowers pink; calyx small, 487.

I. sp. allied to *I. adenoides* Bak. f.

Common on north-western slopes of mountain, 154: frequent on rocky slopes east of pan, 566.

[Our specimens from *I. adenoides* having 3–5-foliolate leaves, minute stipules, fruits set with a few short glands and stems covered with minute almost sessile glands (H.G.S.).]

16. **Psoralea pinnata** var. **latifolia** Harv.

Vlei behind homestead; slender shrub attaining a height of about 5 metres, 202.

17. **Sylitra contorta** (N.E. Br.) Bak. f.

In sandy area north of pan near *Catophractes* belt, 508: between Zoutpan and Waterpoort, in open sandy soil, 267.

18. **Tephrosia zoutpansbergensis** Bremekamp

Very occasional, shrub 1–1·5 metres high, on northern slopes of mountain, 174.

T. capensis (Thunb.) Pers.

On lower slopes of the mountain, 531.

T. purpurea Pers. **forma** ?

East of pan in shade of *Acacia*, 543.

T. euchroa Verdoorn sp. nov. ab *T. noctiflorae* floribus multo majoribus differt et ab speciebus omnibus Transvaale valde distincta.

Suffrutex parvus plus minusve 30 cm. altus, multiramosus, erectus vel rami decumbentes. *Rami* cano-pubescentes, glabrescentes, internodiis 2·5–3 cm. longis. *Folia* imparipinnata 2–6-juga, fololis oblanceolata-oblongis vel oblongis, 1·5-3 cm. longis, 5–9 mm. latis utrinque cano-pubescentibus, superne ultimo glabrescentibus, apice minute mucronatis vel retusis petiolatis, petiolulis 3 mm. longis, dense cano-pubescentibus. *Stipulae* lanceolatae, acutae, 5 mm. longae, cano-pubescentes, 3-nervatae. *Racemi* folia longiores, laxiflori. *Flores* 1·5- 2 cm. longi, rubicundi. *Bracteae* lanceolatae, acutae, 4 mm. longae, cano-pubescentes. *Calyx* cano-pubescens, in toto 5 mm. longus, lobis triangularibus 1–3 mm. longis. *Vexillum* extus appresse pubescens, suborbiculare, 1·5–2 cm. longum et latum; carina circiter 1·6 cm. longa, 1 cm. lata, quam vexillum paullo brevior et quam alae paullo longior. *Legumen* immaturum lineare, apresso-cano-pubescente.

Transvaal.—Zoutpansberg distr: On lower slopes of the Zoutpansberg, on farm "Zoutpan," among rocks, flowers pinky-red, April, 1934, *Schweickerdt* and *Verdoorn*, 529; on rocky N.W. slopes of the Zoutpansberg, November, 1932, *Obermeyer*, *Schweickerdt* and *Verdoorn*, 73 (type).

This is very distinct from all the known Transvaal species of *Tephrosia*. The silvery-grey colour of the bush and the pinkish-red flowers suggested the specific name. It is somewhat like *T. noctiflora* but has much larger flowers. The flowers of each raceme develop at different intervals and one finds several large open flowers while the buds above are still very immature.

19. **Sesbania aculeata** Pers.

Herbaceous, about 60 cm. high, near margin of pan, 454.

20. **Ormocarpum trichocarpum** (Taub.) Harms (*O. setosum* Burtt Davy).

Small tree at foot of mountain, south-east of pan, 582.

21. **Stylosanthes mucronata** Willd.

In dry rocky soil between Waterpoort and Wylie's Poort, 336.

22. **Lonchocarpus capassa** Rolfe

Dominant, large tree in area between pan and foot of mountain, 8.

23. **Abrus laevigatus** E. Mey.

In vlei behind homestead, 206.

24. **Glycine javanica** L.

Twiner on trees along stream leading from kloof; flowers white in long erect racemes, 597.

25. **Neorautanenia edulis** C.A. Sm.

Sandy area about 3 miles west of pan, 645; in *Catophractes* belt, 183: farm "Kromhoek," north of Blaauwberg, 81: between Zoutpan and Waterpoort, 271.

26. **Rhynchosia minima** DC.

Twining in *Capparis* near margin of pan, 473.

27. **Eriosema psoraleoides** (Lam.) Don (*E. cajanoides* Benth.).

In vlei soil behind homestead, 594.

28. **Otoptera Burchellii** DC.

Frequent in sandy area about 3 miles west of pan, 643: farm "Eyem," north of Blaauwberg, 100.

29. **Dolichos Schlechteri** (Harms) Burtt Davy

Creeping in small shrubs in *Catophractes* belt, 185.

[This species was originally described as *Phaseolus Schlechteri* Harms in Engl. Bot. Jahrb. XXX, 91 (1901). In the type description Harms makes no mention of the shape of the stigma, although at some time or other he apparently was somewhat in doubt as to which genus to refer it to. Burtt Davy in his Flora of the Transvaal cites this species under *Dolichos Schlechteri* Harms MS apparently not having been aware of the fact that Harms had described it under another name. The penicillate stigma is not characteristic of *Phaseolus* and Burtt Davy has correctly aligned this plant with others at present under *Dolichos* (H.G.S.).]

30. **Alistilus bechuanicus** N.E.Br.

On upper slopes of mountain, a creeping procumbent herb, peduncles erect, flowers pink, 317.

86. GERANIACEAE.

1. **Monsonia glauca** Knuth

Very sandy area about 3 miles west of pan, 640.

90. ZYGOPHYLLACEAE.

1. **Tribulus terrestris** L.

Under cover of *Acacia* east of pan, 539.

T. zeyheri Sond.

Along roadside, Vivo, 650: between Zoutpan and Waterpoort, 263: under thorn fence of kraal east of pan, 299.

2. **Balanites australis** Bremekamp

West of pan, scattered but frequent, 479: near margin of pan, 15, 33. A small, very thorny tree.

91. RUTACEAE.

1. **Toddaliopsis Bremekampii** Verdoorn

Frequent on northern slopes of mountain behind homestead; a shrub or small tree with tri-foliolate leaves; flowers small, greenish; fruits warted, 66, 156, 567.

2. **Fagara capensis** Thunb.

Farm "Elsteg," about 6 miles west of Louis Trichardt, in shade on rocky slopes, 346, 347. Two trees growing near together, one 3 or 4 ft. high with small leaves (probably a young tree) and the other about 8 ft. high with larger leaves (I.C.V.).

3. **Clausena anisata** (Willd.) Hook. f. (*C. inaequalis* var. *abyssinica* Engl.).

Farm "Elsteg," about 6 miles west of Louis Trichardt; small tree, bad odour, 356.

92. SIMARUBACEAE.

1. **Kirka pubescens** Burtt Davy
Large spreading tree, fairly frequent on northern slopes of mountain, 163.

93. BURSERACEAE.

1. **Commiphora pyracanthoides** Engl.
North of pan in *Catophractes* belt; shrub; flowers red and yellow, 48, 49, 512: on slopes of mountain; small tree with greenish stems, 159.

C. Marlothii Engl.
In dry parts of kloof behind homestead; tree with papery bark, 121: frequent on northern slopes of mountain, 165.

C. calciicola Engl.
North side of pan near *Catophractes* belt; flowers red; leaves 3-foliolate; fruit red, oblique, 180, 511: between Louis Trichardt and Pietersburg, 663.

C. cinerea Engl.
On lower slopes of mountain behind homestead, tree about 8 metres high, 152.

C. sp. near *C. mollis* and *C. Welwitschii* but material insufficient for specific identification.
Farm "Eyem," north of Blaauwberg, 95.

94. MELIACEAE.

1. **Ptaeroxylon obliquum** (Thunb.) Radlk.
In upper drier parts of kloof behind homestead; small slender tree, 118.

2. **Entandophragma caudatum** Sprague
On northern slopes of mountain; tree about 10 metres high; leaves with long drip-points, 306.

3. **Ekebergia Meyeri** Presl
Above stream leading from kloof behind homestead; spreading tree, 112.

98. EUPHORBIACEAE.

1. **Pseudolachnostylis maprouneaefolia** Pax
Northern slopes of mountain, 74, 75, 117.

2. **Fluggea virosa** Baill.
Near foot of mountain in *Lonchocarpus* belt, 6, 10, 521.

3. **Phyllanthus reticulatus** Poir
At foot of mountain, east of pan; tree about 8 metres high, 620.

4. **Bridelia mollis** Hutch.
In kloof behind homestead, 599b; northern slopes of mountain, 243.

5. **Androstachys Johnsonii** Prain
Tree, 5–8 metres high, very frequent in Wylie's Poort, 327.

6. **Croton gratissimus** Burch.
Fairly frequent on northern slopes of mountain; small tree, 157, 169.

C. megalobotrys Müll. Arg. (*C. Gubouga* S. Moore).
Tree, about 5 metres high, near homestead, 4: beside stream leading from kloof, 106.

C. pseudopulchellus Pax

On upper slopes of mountain, locally abundant; small shrub, about 1 metre high, 303, 316.

7. **Acalypha glabrata** Thunb.

Farm "Elsteg," about 6 miles west of Louis Trichardt; shrub, about 2·5 metres high, 348.

A. indica L.

In shade of *Acacia*, east of pan, 535.

8. **Tragia Okanyua** Pax

Northern slopes of mountain, twining in *Croton sp.*, 283.

9. **Plukenetia africana** Sond.

Climber, in *Acacia sp.*, east of pan, 552.

10. **Jatropha erythropoda** Pax et Hoffm.

In *Catophractes* belt, 194: on farm "Zoutpan," on road to Waterpoort, 262.

J. zeyheri Sond. forma.

Near farm "Eyem," north of Blaauwberg, 101.

[This specimen differs from *J. Schlechteri* Pax in the more strongly lobed, less pubescent and shorter petioled leaves and the glabrous calyx. In the latter character our plant also differs from *J. zeyheri* Sond. but approaches it with regard to leaf-shape and length of petiole. Since the last two characters appear to be of some importance in the delimitation of the S. African species of this genus, I place our gathering under the above species and regard it as a form until more material becomes available for study (H.G.S.).]

11. **Spirostachys africana** Sond.

In Lonchocarpus belt near homestead, tree 5–7 metres high, 77: almost on margin of pan, 35.

12. **Euphorbia aeruginosa** Schweickerdt.

On northern rocky slopes of mountain, 151, 688.

E. Cooperi N.E. Br.

On northern slopes of mountain near homestead, 649.

E. Gürichiana Pax

In *Catophractes* belt; small bush, branched at base, up to 50 cm. high; flowers yellow or green, 178, 513.

E. Tirucalli L.

Plentiful in parts of Wylie's Poort, 676.

E. transvaalensis Schltr.

On rocky slopes in Wylie's Poort, 369.

13. **Monadenium Lugardae** N.E.Br.

On mountain slopes east of homestead, forming patches; stems decumbent, rooting where they touch the ground, about 40 cm. high, 648.

14. **Cluytia pulchella** var. **obtusata** Sond. ?

Shrub, near waterfall on farm "Elsteg," about 6 miles west of Louis Trichardt, 366.

101. ANACARDIACEAE.

1. **Rhus Gueinzii** Sond.

On margin of vlei, west of homestead, 231.

R. pyroides var. **gracillis** (Engl.) Burtt Davy
In marshy soil near vlei, 222.

R. transvaalensis Engl.
Farm "Elsteg," about 6 miles west of Louis Trichardt, 365.

103. CELASTRACEAE.

1. **Cassine Schlechteri** (Loes.) Davison
Small tree, in *Lonchocarpus* belt beyond vlei, bearing somewhat pointed ripe fruits, 577: same locality, tree, ripe fruits globose, 576: small tree, on northern slopes; fruits immature, 237.

Rehmann, 6459 from Houtbosch, Transvaal, referred to the above species in Herb. Kew has oblong apiculate fruits as in our No 577. In the latter sheet the apiculus of the fruits is more pronounced. No 576 has spherical fruits without an indication of an apiculus, but does not differ from 577 in other respects. Until more material, both flowering and fruiting, has been studied, it is impossible to decide whether the above specimens represent distinct varieties (or even species) or whether only one species variable with regard to leaf size and shape of fruits is involved. In the type description of *Mystroxylon Schlechteri* [Loes in Engl. Bot. Jahrb., 28, 159 (1901)] no mention of the fruits is made.

104. HIPPOCRATEACEAE.

1. **Hippocratea longipetiolata** Oliv.
Between Zoutpan and Waterpoort; small shrub, with long spreading branches, 254.

106. SAPINDACEAE.

1. **Cardiospermum alatum** Bremekamp and Obermeyer
East of pan, climber, on *Gossypium*, 559.

109. RHAMNACEAE.

1. **Zizyphus mucronata** Willd.
Between Waterpoort and Wylie's Poort, 326.
2. **Berchemia discolor** (Kl.) Hemsl.
Northern slopes of mountain, 279: frequent in *Lonchocarpus* belt, 278.

111. VITACEAE.

1. **Cissus lonicerifolius** C. A. Smith
Farm "Eyem," north of Blaauwberg; shrub, 2 metres high; leaves folded, pungent odour, 96.

Usually a shrub, varying from 1–3 m. high, much branched; tendrils usually only found near end of branches.

C. quadrangularis L.
Between Zoutpan and Waterpoort, climbing in small shrubs, 261.

C. simulans C. A. Smith
Farm "Elsteg," about 6 miles west of Louis Trichardt, luxuriant climber, 361.

C. unguiformifolius C. A. Smith
Between Waterpoort and Wylie's Poort, abundant, procumbent, 330.

112. TILIACEAE.

1. **Corchorus pongolensis** Burtt Davy and Greenway ?

On lower slopes of mountain behind homestead, 67. A slender shrub, up to 130 cm. high, differing from the type by having somewhat shorter bracts, but otherwise agreeing fairly well.

[Our plant is allied to *C. Kirkii* N. E. Br. but may be readily distinguished by the indumentum (H.G.S.).]

C. asplenifolius Burch.

Under *Acacia*, east of pan, 536, 541.

2. **Grewia flava** DC.

In open parts of *Catophractes* belt, 56.

G. hexamita Burr.

Shrub, about 3 metres high, near margin on east of pan, 149.

G. retinervis Burr.

Near homestead, under cover of *Terminalia*, 2: on slopes of mountain behind homestead, 244.

G. occidentalis L.

Tree, 7–8 metres high, in Wylie's Poort, 341.

G. Schweickerdtii Burr. sp. nov.

Frutex 8-10 pedes altus. *Rami* cortice rubro, ramuli breviter virgati, superne pilis stellatis multi-ramosis, sat longis, flavidis plus minus interrupte villosi. *Stipulae* lanceolatae. *Petiolus* in latere longiore usque 6 mm. longus, validus, flavido-villosus; lamina basi valde obliqua, in altero latere rotundata, in altero auriculari formiter producta, cordata, praeterea ambitu elliptica vel elongato-elliptica, maxima visa 5 cm. circ. longa, 3–4 cm. lata, supra glabra, nitens, rugosa, nervis nervulisque impressis, sat dense reticulata, subtus pallide flavido-velutina, costa atque nervis lateralibus minus pilosis i.e. colore brunneo notalis, nervatione ulteriore vix conspicua, margine revoluto, leviter crenato, apice plerumque rotundato, rarius subapiculato. *Cymae* floriferae axillares, solitariae, 1–3-florae, in modo ramulorum pallide fusco-flavido-villosae. *Pedunculus* 0·5–1·0 cm. circ. longus. *Pedicelli* bracteis oblongo-lanceolatis vel lanceolatis, intus glabris, extra pubescentibus suffulti, pedunculo subaequilongi. *Albastra* oblonga. *Flores* speciosi. *Sepala* 2·4 cm. longa, linearia, extra pilis stellatis brevissimis atque longis fusco-flavidis multiramosis interrupte sequentibus vestita. *Petala* ungui subcircularia 4 mm. in diam. circ. metiente, dorso pilosulo, antice supra aream glanduligerum squamiformiter libero, dense, late, minus late in lateribus flavido-tomentoso; lamina late obovata vel potius suborbicularis, apice leviter excisa. *Androgynophorum* supra petalorum unguem flavide villosum conspicue productum, dein stamina numerosa, 1·5 cm. fere longa, atque gynaeceum flavido-villosum obovatum praebeus. *Stylus* longitudine staminum, glaber, gynaeceo subito impositus; stigmata dilatata, applanata, late rotundata. Ovula pro loculo 8, biseriata, pro serie 4.

Transvaal.—Zoutpansberg distr.: Farm "Zoutpan 193," in kloof behind homestead, shrub, 8–9 ft. high, November, 1921, *Obermeyer, Schweickerdt* and *Verdoorn*, 120.

G. Schweickerdtii is closely allied to *G. hexamita*, but differs in having much longer petioles, large flowers and much larger leaves.

G. sp. near *G. flava* DC. (Material too poor for description.)

Shrub, about 3 metres high, near homestead, 147.

113. MALVACEAE.

1. **Abutilon austro-africanum** Hochr.

Small shrub, near eastern margin of pan, 114: between Zoutpan and Waterpoort, 270: in shade of *Acacia sp.*, east of pan, 558.

2. **Sida cordifolia** L.

Small shrub, about 60 cm. high, frequent in open patches east of pan, 556: frequent in vlei soil and in shade of trees in *Lonchocarpus* belt, 234.

S. flexuosa Burtt Davy

Frequent in sandy soil between Zoutpan and Waterpoort, 253.

S. Hoepfneri Guerke.

Shrub, about 1 metre high, along eastern margin of pan, 118.

3. **Pavonia Burchellii** (DC.) R. A. Dyer

Small shrub, about 20 cm. high, in sandy soil of *Catophractes* belt, 506, 189.

P. dentata Burtt Davy

On rocky ledges in drier upper parts of kloof behind homestead, 126: on rocky mountain slopes, 167: in Wylie's Poort, on rocks, 671.

4. **Hibiscus micranthus** L.

Shrub, about 1 metre high; flowers small, white, turning pink or red when folding up again; in *Catophractes* belt, 504, 195.

H. dongolensis DC.

On northern slopes of mountain near pan, 575a.

H. physaloides G. and P.

Near homestead, in *Lonchocarpus* belt; flowers yellow with red blotch at base of petals, 25.

H. physaloides G. and P. forma ?

Frequent along eastern margin of pan, flowers red or yellow with red blotch at base of petals, 145, 555. [In foliage and habit the above gatherings resemble *H. Schinzii* Guerke very closely but have flowers twice the size. In Herb. Hort. Bot. Berol. several sheets named *H. physaloides forma* matched our gatherings. I am inclined to think that our specimens and those in Berlin Herb. represent a distinct variety with *H. Schinzii* as closest affinity, since the latter as well as our plants are prostrate in habit, whereas *H. physaloides* apart from having much larger leaves is usually an erect under-shrub (H.G.S.).]

H. praeteritus R. A. Dyer

Foot of mountain, east of pan, in shade of trees; about 2 metres high, 575; between Zoutpan and Waterpoort, 257: at northern end of Wylie's Poort, 338. This plant had white flowers, which, however, turned red on drying: in all other respects it agreed with the typical form.

H. intermedius A. Rich. var. **aristaevalvis** Guerke

Under small *Acacia*, on margin of pan; flowers creamy-yellow, 32, 476. These specimens agree well with *Lüderitz* 82 from S.W. Africa in the Herb. Hort. Bot. Berol.

5. **Gossypium africanum** Watt (*G. transvaalense* Watt).

Frequent in scrub and bush east of pan, 564, 135.

[I find no specific difference between *G. africanum* and *G. transvaalense*. Both occur in the same geographic area (H.G.S.).]

114. BOMBACACEAE.

1. **Adansonia digitata** L.

On northern rocky slopes behind homestead, 69.

The South African material which we have so far examined differs from true *A. digitata* L. from West Africa in the following characters: The flowers and fruits are shortly pedunculate and the petals never reflex as shown in the figure in Memorias de Sociedade Broteriana I, 50 et t. 5 (1930). The plant figured was from Portuguese Guinea which is near the type locality and thus may be considered to be true *A. digitata* L. If any value is to be attached to the differences recorded above the South African form may deserve varietal rank. Further investigation, however, is necessary before any decisive step can be taken.

115. STERCULIACEAE.

1. **Melhania Rehmannii** Szyszyl.

Near homestead, 188a.

2. **Hermannia boraginiflora** Hook.

Lower slopes of mountain, east of pan; flowers pale mauve, 142, 562.

H. Holubii Burtt Davy

In sandy soil near Vivo; flowers brick red, 652: in shade of *Acacia* trees near margin of pan, 486.

H. grisea Schinz

In open soil, east of pan; flowers pale pink to brownish, 553.

3. **Waltheria americana** var. **indica** K. Schum.

In open soil, east of pan, common, 554.

4. **Sterculia Rogersii** N. E. Br.

In sandy area west of pan, 87. A small (stunted ?) shrub with a succulent bole.

116. OCHNACEAE.

1. **Ochna atropurpurea** DC.

Near summit of northern slopes of mountain, 312.

2. **O. sp. nov.**

Between Waterpoort and Wylie's Poort, 335.

[This specimen matches *Rogers* 19398 from Messina and *Baines* s.n. from "S.A. Gold Fields" in Herb. Kew. It is very probably an undescribed species. *Rogers* 19398 is quoted under *O. pretoriensis* by Phillips in Bothalia I, ii, 95 (1922) but does not belong to that species, differing from it in leaf character as well as the articulation of the pedicel (H.G.S.).]

117. GUTTIFERAE.

1. **Hypericum Lalandii** Choisy.

Along stream leading from vlei behind homestead, 204.

2. **Garcinia Livingstonei** And.

Occasional trees, on lower rocky slopes of mountain; flowers sweetly scented; fruits orange-coloured, oblique, fleshy, edible, 71, 62.

123. FLACOURTIACEAE.

1. **Trimeria grandifolia** (Hochst.) Warb.

Farm "Elsteg," about 6 miles west of Louis Trichardt, 354.

124. TURNERACEAE.

1. **Piriqueta capensis** (Harv.) Urb.
   Between Waterpoort and Wylie's Poort, 339.

125. PASSIFLORACEAE.

1. **Adenia repanda** (Burch.) Engl.
   Between Zoutpan and Waterpoort, in open sandy soil, climbing over small bushes, not very frequent; tuber subterranean, 246.

137. COMBRETACEAE.

1. **Combretum apiculatum** Sond.
   In upper drier parts of kloof behind homestead, 603.

C. mossambicense (Klotzsch) Engl.
   Near eastern margin of pan, liane on *Lonchocarpus*; flowers white; anthers red, 143. This constitutes the first record of the species for the Transvaal.

2. **Terminalia prunioides** Laws.
   Tree, ± 8 metres high, frequent in *Catophractes* belt, 191.

T. Rautanenii Schinz
   Adjoining farm "Zoutpan," near Vivo, 83. A shrubby tree, attaining a height of 4–5 metres with much the habit of an *Ehretia*. It is fairly frequent in the sandy areas adjoining the pan. This is the first record of the species from the Transvaal.

T. sericea Burch.
   In *Lonchocarpus* belt adjoining the homestead, 1.

138. MYRTACEAE.

1. **Syzygium cordatum** Hochst.
   On slopes behind homestead, 63.

140. ONAGRACEAE.

1. **Jussiaea augustifolia** Lam.
   Growing in bed of periodic stream leading from mountain to south-eastern margin of pan, 559a.

143. UMBELLIFERAE.

1. **Hydrocotyle asiatica** L.
   Near vlei to west of homestead, 225.

H. verticillata Thunb.
   Frequent along stream leading from kloof, 200.

2. **Steganotaenia araliacea** Hochst.
   In Wylie's Poort, fairly frequent; chasmophyte, 331.

146. MYRSINACEAE.

1. **Maesa lanceolata** Forsk.
   Along water-course leading to kloof, 113.

147. PRIMULACEAE.

1. **Samolus Valerandi** L.

Farm "Elsteg," about 6 miles west of Louis Trichardt. abundant on banks of stream, 363.

149. SAPOTACEAE.

1. **Chrysophyllum magalismontanum** Sond. (*C. Wilmsii* Engl.).

Near summit of northern slopes of mountain, 305.

2. **Mimusops Zeyheri** Sond.

Farm "Elsteg," 6 miles west of Louis Trichardt, 361a.

150. EBENACEAE.

1. **Royena sp.** (not matched at Kew).

Near camp; fruit small, 277.

2. **Euclea divinorum** Hiern

Farm "Eyem," north of Blaauwberg, 98.

E. Guerkei Hiern

Farm "Elsteg," about 6 miles west of Louis Trichardt, 358.

E. lanceolata E. Mey. ex Drège ?

Farm "Elsteg," about 6 miles west of Louis Trichardt, 371.

E. multiflora Hiern

In deep sandy soil, east of pan, 622.

151. OLEACEAE.

1. **Jasminum stenolobum** Rolfe

Farm "Eyem," north of Blaauwberg; small erect bush, about 1 m. high, 92.

152. SALVADORACEAE.

1. **Salvadora australis** Schweickerdt sp. nov.

Affinis **S. persicae** *Garcin ex Linn. et* **S. oleoidi** *Decne, sed ab illa indumento persistente calyce valde lobato antheris multo minoribus stylo distincto, ab hac antheris maioribus connectivo haud producto stylo distincto indumento persistente differt.*

Frutex divaricato-ramosus vel arbor usque ad 8 m. alta; rami iuniores minute et dense cinereo-puberuli, teretes; internodia ad 2 cm. longa, 2 mm. diametro. *Folia* breviter petiolata vel fere sessilia, spatulata vel oblanceolata, obtusa, basin versus sensim attenuata, usque ad 5 cm. longa, et 1 cm. lata, integra, utrinque minute sed dense puberula, nervis infra prominentibus supra inconspicuis. *Flores* viridi-flavi, in paniculis terminalibus vel axillaribus dispositi. *Paniculae* circiter 2 cm. longae, multiflorae. *Bracteae* minutae, 0·75 mm. longae, ovatae, dense cinereo-puberulae, minute ciliolatae. *Calyx* circiter 2 mm. longus, extra dense et minute puberulus, dimidio lobatus, lobis reflexis obtusis dense et minute ciliolatis. *Corolla* plus minusve 3 mm. longa, profunde lobata; lobi triangulares, acuti, sub anthesi reflexi. *Stamina* corolla breviora; antherae minutae, fere 0·75 mm. longae, glandulis interstaminalibus distinctis sed minutis. *Ovarium* circiter 1 mm. diametro, globosum, minute puberulum; stylus circiter 0·25 mm. longus, distinctus, stigmate inconspicuo. *Fructus* 6 mm. diametro, semitranslucens, globosus, minute puberulus.

PORTUGUESE EAST AFRICA.—Mapae: Guija, in bush country in sandy soil, about 1 mile from the Limpopo River, July, *Lea*, 5 (syn-type flowers).

TRANSVAAL.—Zoutpansberg distr.: Farm "Zoutpan 193," on northern slopes of Zoutpansbergen, tree about 8 m. high, November, *Obermeyer, Schweickerdt* and *Verdoorn*, 18 (syn-type fruits); *Keet in Forest Dept. Herb.*, 6833; Messina, *Pole Evans*, 1453.

NATAL. Zululand: Mkuzi, on Lebombo Flats, *Galpin*, 13320.

This is closely related to the Indian species *S. oleoides* Dec. from which it may be distinguished by having larger anthers, a connective which is never produced and columnar style. I have not observed the latter in either *S. persica* or *S. oleoides*. The persistent indumentum on branches, leaves and floral parts is a character by which the southern African species may be at once recognised.

153. LOGANIACEAE.

1. **Strychnos Schumanniana** Gilg

On rocky ledges behind homestead, 64.

S. innocua Del. (*S. Quaqua* Gilg; *S. dysophylla* Benth.).

Occasional on northern slopes of mountain, 161.

2. **Anthocleista zambesiaca** Bak.

In kloof behind homestead, 115.

This is probably one of the most conspicuous of South African forest trees, always growing in very damp situations, usually in ravines. It is more or less 30 metres high and is not much branched. The branches are erect and bear a crown of large simple leaves near their apex. The flowers are gardenia white.

3. **Lachnopylis montana** C. A. Smith

Farm "Elsteg," about 6 miles west of Louis Trichardt, 344.

155. APOCYNACEAE.

1. **Landolphia Kirkii** Dyer var. **delagoense** Dew.

Upper slopes of mountain, fairly common; shrub, 1·5 metres high, 304, 172.

2. **Pachypodium Saundersii** N. E. Br.

Near roadside among rocks in Wylie's Poort, 668.

3. **Strophanthus Gerrardii** Stapf

Frequent in bush, west of homestead, 579. This interesting liane is fairly common in the dense bush at the foot of the mountain. It climbs to the tops of tall trees and not much of its foliage is visible. The two-winged, twisted stems, however, attract one's attention immediately (two opposite wings run vertically throughout the length of the internode with the plane of the wings at right angles to those of the internodes above and below).

156. ASCLEPIADACEAE.

1. **Cryptolepis obtusa** N. E. Br.

Twiner in *Cassia*, in bush west of homestead, 591.

2. **Stomatostemma Monteiroae** (Oliv.) N. E. Br.

On upper slopes of mountain; liane on *Commiphora sp.*, 320.

3. **Asclepias Burchellii** Schltr.

In open veld near homestead, 23.

4. **Secamone Gerrardi** Harv.

Farm "Elsteg," about 6 miles west of Louis Trichardt, 352.

S. zambesiaca var. **parvifolia** N. E. Br.

Twiner on *Euphorbia Cooperi*, east of homestead, 138.

5. **Ceropegia cimiciodora** Obermeyer

Farm "Chapudi," between Waterpoort and Zoutpan, creeping in low bushes, 322. A fleshy-stemmed creeper with striking flowers.

6. **Tavaresia grandiflora** (K. Schum.) Berger

Between Waterpoort and Zoutpan, in sandy soil under cover of *Acacia* scrub, 413.

7. **Caralluma atrosanguinea** N. E. Br.

Farm "Chapudi," between Zoutpan and Waterpoort, 446.

C. Schweickerdtii Obermeyer sp. nov. (*C. carnosa* Schweickerdt in Flowering Plants of South Africa, XV, plate 592, *non* Stent).

Caules carnosi, erecti vel adscendentes, basi ramosi, 4-angulati, 17 cm. alti, 3–4–5 cm. diam. (dentibus inclusis), glabri, virides, brunneo-maculati; anguli dentibus patentibus. deltoideis, 1·5 cm. longis, compressis instructi. *Flores* ad apicem ramorum, 1–3 aggregati. *Pedicelli* ad 3 mm. longi. *Sepala* 4 mm. longa, lanceolata, acuta, sini flagellis instructi. *Corolla* 1 cm. longa, 1–2 cm. in diam., campanulata, extus glabra, viridia, intus purpureo-rubra, paullum cremeo-maculata, papillosa, aliquando pilis bulbosis, clavatis indutis; tubus annulo pentagono, parvo, instructis; lobi deltoidei, 5 mm. longi, 7 mm. lati, paullum patentes. *Corona* exterior crateriformis, lobi aliquando lyrati, patentes, ad apicem paullum concavi vel bifidi roseo-cremei; lobi interior supra antherarum incumbenti, maculati, dorso, carnoso-gibbosi.

TRANSVAAL.—Zoutpansberg distr.: Farm "Chapudi," near Waterpoort, in sand, *Obermeyer*, *Schweickerdt* and *Verdoorn*, 411 (*National Herbarium, Pretoria*, 19597; *Herb. Transvaal Museum*, 34945).

This species is closely related to *C. Keithii* Dyer but may be distinguished as follows: In *C. Keithii* the corolla tube is thin and minutely verrucose, different to the fleshy, densely papillate lobes. There is, however, no sharp distinction between the corolla-lobes and the tube in *C. Schweickerdtii*. The very peculiar bulbous-based clavate unicellular hairs tipping some of the long papillae are smaller and fewer, while the margin of the corolla-lobes is not fringed with a row of minute hairs; there are, however, some scattered over the whole inner surface. The outer corona-lobes of *C. Schweickerdtii* bend outwards and are more or less lyre-shaped, while in *C. Keithii* they are bifurcate and somewhat incumbent over the staminal column. The inner corona lobes are mottled with purple, while the minute emarginate lobe, spreading slightly between the outer corona-lobes, present in *C. Keithii*, is absent. The five intersepalar flagellae are present in both species, but absent from *C. carnosa* Stent. From this species it may be distinguished by the different colour and smaller size of the corolla, etc.

Between Waterpoort and Zoutpan, 411. This specimen was figured in Flowering Plants of South Africa (plate 592) as *C. carnosa* Stent; Miss Obermeyer, however, rediscovered *C. carnosa* in the type locality and found that our plant differed considerably from it. She has therefore given the above name to our specimen.

C. maculata N. E. Br.

Near Waterpoort, fairly frequent but scattered, 660. This species is rather remarkable as it has horizontal rhizomes at a depth of about 10 cm. below the surface of the soil. Aerial shoots arise from these at some distance from each other. This plant was figured in Flowering Plants of South Africa as *C. grandidens* Verdoorn but was found by Dr. Schweickerdt at Kew to be *C. maculata* N. E. Br. (See Kew Bull., 1935.)

8. **Stapelia clavicorona** Verdoorn

Growing on rocky ledges in Wylie's Poort, 414. Apparently a very rare species since only a few plants have so far been found and only from that locality.

S. Getlieffii Pott

Along margin of pan, fairly frequent, 477: between Zoutpan and Waterpoort, fairly common, 444.

The colour of the flowers of this species is rather variable. Flowers with dark wine-coloured markings and hairs on the corolla and others with very pale, almost yellow corollas and but faint markings were observed on plants growing in the same patch. The inner corona wings also vary but this variation is not constantly associated with the variations in the colour of the corolla.

S. gigantea N. E. Br.

On rocky ledge on slopes behind homestead, 70.

S. nobilis N. E. Br.

Growing in large patches under a large *Acacia* tree near Zoutpan, 445.

S. kwebensis N. E. Br.

At "Vivo," west of Zoutpan, 406: between Zoutpan and Waterpoort, 662.

9. **Huernia zebrina** N. E. Br. var **magniflora** Phillips.

Near farm "Chapudi," between Zoutpan and Waterpoort, 416, 443, 657, 658, 659. Colour forms were noted among these specimens such as black disk and yellow lobes marked with red stripes, and red disk and red lobes with yellow stripes. The outer corona varied too, sometimes appearing pincher-like and on flowers in close proximity (not obviously the same plant) with outer corona not pincher-like.

10. **Pergularia extensa** (Jacq.) N. E. Br.

Climber, on shrubs and bushes, fairly frequent in sandy areas around pan; petals green, with densely ciliate margins, 3, 90.

11. **Fockea augustifolia** K. Schum. ?

In *Catophractes* belt, north of pan, 187 (poor specimen).

157. CONVOLVULACEAE.

1. **Seddera suffructicosa** (Schinz) Hall. f. var. **hirsutissima** Hall. f.

In sandy soil of *Catophractes* belt, 177, 509.

2. **Ipomoea adenioides** Schinz.

Fairly frequent in *Catophractes* belt; flowers exquisite, white with wine-coloured throat, opening at sundown, 181.

I. quinquefolia var. **purpurea** Hall. f.

On sandy soil, climbing over low scrub, between Louis Trichardt and Pietersburg, 665.

I. Lugardi var. **parviflora** Rendle

In shade of *Acacia*, east of pan; flowers bluish-pink with dark pink throat, 542.

3. **Merremia pinnata** (Hochst.) Hall. f.

On north-east side of pan, in shade of *Acacia*; flowers bright yellow, 568.

[The specimens from Trop. Afr. in Herb. Kew are more robust and more pubescent than the above gathering (H.G.S.).]

159. BORAGINACEAE.

1. **Cordia ovalis** R. Br.

Small tree, in *Catophractes* belt, very occasional, 192. First record of the species for the Transvaal.

2. **Ehretia rigida** (Thunb.) Druce
North side of pan, fairly frequent, 44, 45.

3. **Heliotropium curassavicum** L.
On very margin of pan, a typical halophite, 288, 465.

H. lineare C. H. Wright
Between Zoutpan and Waterpoort, in open sandy soil, 248.

H. Nelsoni C. H. Wright
Very occasional under *Acacia*, near margin of pan, 20, 482, 510.

160. VERBENACEAE.

1. **Lippia asperifolia** Rich.
In *Lonchocarpus* belt and on northern slopes of mountain, 7, 129, 519, 520.

2. **Clerodendron myricoides** R. Br.
At upper end of kloof behind homestead, 602. The leaves of this specimen are more coarsely serrate than in the material from Trop. Africa.

C. ternatum Schinz
Very sandy area, about 3 miles west of pan, 641.

C. simile Pearson
Undershrub, on farm "Chapudi," between Zoutpan and Waterpoort, 252.

161. LABIATAE.

1. **Leonotis dysophylla** Benth.
Under tree in vlei area on slopes above pan, up to 3 metres high, 229.

2. **Leucas glabrata** R. Br.
Farm "Elsteg," about 6 miles west of Louis Trichardt, 364.

L. sexdentata Skan
In shade and in open veld near margin of pan, 491.

3. **Aeolanthus Rehmannii** Guerke
On rocky slopes, rooting in fissures, Wylie's Poort, 670.

4. **Endostemon tereticaulis** (Poir) Ashby (*E. ocimoides* Bremekamp).
Frequent among loose stones on eastern margin of pan; flowers purple, 140.

5. **Pycnostachys reticulata** Benth.
In shade along bank of stream, behind homestead; flowers a beautiful blue, 518.

P. densiflorus Cooke
In sandy soil, between Louis Trichardt and Pietersburg, 447.

6. **Ocimum americanum** L.
Near margin of pan; flowers small, pink and white, 494.

7. **Becium obovatum** N. E. Br.
Near margin of pan under cover of *Acacia*; flowers dirty white with mauve markings; stamens long exserted, 475.

8. **Hemizygia canescens** (Guerke) M. Asbhy (*Orthosiphon canescens* Guerke).
On slopes of mountain behind homestead; small bush with strong odour, 613.

162. SOLANACEAE.

1. **Solanum incanum** L.

Near margin of pan, growing in association with *Acacia* scrub, 134.

S. panduriforme E. Mey.

East fringe of pan, common, 547.

S. kwebense N. E. Br.

In *Catophractes* belt; flowers white, 54: flowers purple, 57. First record of this species for the Transvaal.

2. **Lycium sp.**

Five collections were made (22, 39, 42, 474, 503) which have not been specifically identified and a revision of the genus appears very necessary.

163. SCROPHULARIACEAE.

1. **Aptosimum lineare** Marl. and Engl.

In sandy soil, between Louis Trichardt and Pietersburg, 666: between Zoutpan and Waterpoort in open sandy soil, 266: Vivo, 655.

A. patulum Bremekamp

Under *Acacia*, east of pan, 565: at foot of mountain, near upper vlei, 581.

2. **Peliostomum leucorrhizum** E. Mey.

Farm "Eyem," north of Blaauwberg, 94.

3. **Limosella maior** Diels

In stream leading from kloof and vlei, 216.

4. **Ilysanthes dubia** (L.) Bernh. (*I. capensis* Benth; *I. riparia* Raf.).

Near vlei behind homestead; flowers white, 217.

5. **Ramphicarpa tubulosa** (Linn. f.) Benth.

In grassy patches on slope of mountain, 233.

6. **Striga gesnerioides** (Willd.) Vatke (*S. orobanchoides* Benth.).

Growing under cover of and parasitic on the roots of *Euphorbia Cooperi*, east of homestead, 127.

164. BIGNONIACEAE.

1. **Rhigozum obovatum** Burch.

Frequent in *Catophractes* belt; flowers yellow, 53.

R. zambesiacum Bak.

Between Waterpoort and Wylie's Poort, 340.

2. **Catophractes Alexandri** Don.

Dominant in a belt north of pan and owing to this the term "Catophractes belt" is spoken of in this paper, 514, 58.

165. PEDALIACEAE.

1. **Pterodiscus ngamicus** N. E. Br.

Along sandy western margin of pan, 427. (A poor plant of what might be another species of *Pterodiscus* was observed).

2. **Harpagophytum Zeyheri** Decne ?

In sandy soil, west of pan, 689. The specimen is not in fruit and hence it is impossible to name it specifically.

3. **Sesamothamnus Lugardii** N. E. Br.

Frequent in very sandy area, north of pan, 59. Comparison of our specimen with fruiting material from South West Africa named *S. Seineri* Engl. in Herb. Hort. Bot. Berol (see Engl. and Drude, Veg. der Erde, 9, I, 2, p. 586 and tab. 28, 2 (1910)] suggests that these two species are the same. Flowering material of *S. Seineri* is necessary to decide this question. In any case *S. Lugardii* (1906) has priority.

3. **Sesamum capense** Burm.

East of pan, occasional, 557.

4. **Ceratotheca triloba** E. Mey.

Very frequent at foot of mountain below upper vlei, 583.

5. **Pretraea zanguebarica** Gay

Along south-eastern margin of pan, frequent in patches, 690.

169. LENTIBULARIACEAE.

1. **Utricularia exoleta** R. Br.

Plentiful, but scattered in vlei behind homestead, 209.

170. ACANTHACEAE.

1. **Dyschoriste Fischeri** Lindau

Shrub, up to 1 metre high, between Waterpoort and Wylie's Poort, 333.

2. **Ruellia patula** Jacq.

Margin of pan, under cover of small *Acacia*; flowers white, 28, 167: between Zoutpan and Waterpoort, in shade of shrubs, 250.

3. **Barleria Bremekampi** Obermeyer

Very spiny bush, up to 1 metre high, in kloof behind homestead, 124.

B. elegans S. Moore

Foot of mountain, near *Euphorbia Cooperi*, 130.

B. Galpinii C. B. Cl.

In kloof behind homestead, 123.

B. heterotricha Lindau

In kloof behind homestead, 125.

B. obtusa Nees

On northern slopes of mountain, 162.

B. transvaalensis Obermeyer

In Acacia belt, north of pan, near *Sesamothamnus*, 50.

4. **Neuracanthus africanus** T. Anders. ex Sp. Moore

Between Zoutpan and Waterpoort, fairly frequent among Acacia scrub, 251.

5. **Blepharis Clarkei** Schinz

South-eastern side of pan, in stony surroundings, 291.

B. diversispina (Nees) C. B. Cl.

Farm Zoutpan, 251a.

6. **Asystasia atriplicifolia** Bremekamp

On farm "Eyem" near large baobab, on north-eastern boundary, 89.

7. **Ruspolia erypocrateriformis** (Vahl.) Milne-Redhead var. **australis** Milne-Redhead
Wylie's Poort; shrub, with arching branches, 10 ft. long, hanging over stones; flowers scarlet; fruit green, turning black, 441.

8. **Dicliptera clinopodia** Nees
Under *Acacia*, near eastern margin of pan, 297.

9. **Justicia flava** Vahl.
Western margin of pan, in gravelly soil; flowers yellow; stems procumbent, 21.

J. odora Vahl.
Frequent in *Catophractes* belt, up to 60 cm. high, 190.

J. (Calophanoides) **sp.**
On ledge above kloof, behind homestead, 610.

J. (Ansellia) **sp.**
Above bushman cave on upper slopes of mountain, 168.

173. RUBIACEAE.

1. **Oldenlandia cephalotes** (Hochst.) O. Kuntze (*O. sphaerocephala* Schinz).
In vlei behind homestead, 201.
[Comparison of the types of *O. cephalotes* and *O. sphaerocephala* has convinced me that they represent one species. The leaves are somewhat variable in shape and size as is very often the case in species of *Oldenlandia* (H.G.S.)]

O. decumbens (Hochst.) Hiern
In shady forest patches at foot of mountain, 592.

2. **Randia sp.** near *R. rudis* E. Mey.
Foot of hill, below a group of *Euphorbia Cooperi*, 128.

3. **Gardenia Neuberia** E. and Z.
Small tree, among rocks at roadside in Wylie's Poort, 667.

G. spatulifolia Stapf and Hutch.
Occasional on northern slopes of mountain, tree, about 5 metres high, 158.

4. **Empogona Kirkii** Hook. f. var. **australis** Schweickerdt var. nov. *A typo foliis multo maioribus glabrisque, pedicellis ovario et calyce multo minus pubescentibus differt.*
In *Lonchocarpus* belt, 72 (type); on lower northern slopes of mountain behind homestead; flowers white, densely bearded in the throat, 528.
[No 72 was collected during November, i.e. early summer and therefore shows the presence of well-developed young leaves which are of a thin texture. In shape and size those agree with leaves of 528 collected during April, which, however, are leathery in texture and somewhat shiny on the upper surface. Indumentum of branches, pedicels, ovary and calyx-lobes are similar in both gatherings (H.G.S.).]

5. **Vanguera tomentosa** Hochst.
On northern slopes of mountain, 691.

V. cyanescens Robyns
On northern slopes of mountain, 102.
[Apart from the fact that *Dinter* 58 (type of *V. cynanescens*) has turned partly black on drying (indigo ?), there appears to be no difference between this species and *V. floribunda* Robyns. *Rogers* 18214 (type of the latter) is a fairly robust specimen which is slightly more hairy in the inflorescence than our gathering. A wider range of material will probably prove the above-mentioned species to be identical (H.G.S.).]

6. **Canthium ventosa** (L.) Sp. Moore
Farm "Elsteg," about 6 miles west of Louis Trichardt, 359.

C. **huillense** Hiern
Northern slopes of mountain, 173: in kloof behind homestead, 122.

7. **Pavetta Harborii** Sp. Moore
Between Zoutpan and Waterpoort, locally abundant, 255.

P. **Schumanniana** F. Hoffm. ex K. Schum.
Farm "Elsteg," about 6 miles west of Louis Trichardt, 357.

8. **Plectroniella armata** (K. Schum.) Robyns
In *Lonchocarpus* belt, west of homestead; tree, 5-6 metres high; flowers bearded in throat, 26.

9. **Anthospermum lanceolatum** Thunb.
Farm "Elsteg," about 6 miles west of Louis Trichardt, 362. This gathering is somewhat more pubescent than the typical plant.

176. CUCURBITACEAE.

1. **Corallocarpus sphaerocarpus** var. **scaberrimus** Cogn.
On very margin of pan, climbing in *Acacia*, 30.

2. **Momordica Balsamina** L.
Climbing in and over small *Acacia* in *Lonchocarpus* belt, 14.

3. **Citrullus naudinianus** (Sond.) Hook. f.
Frequent in very sandy area, about 3 miles west of pan, known locally as "gemsbokkomkommer," 646.

C. **vulgaris** Schrad.
Margin of pan, not very frequent, 455.

4. **Cucumis africanus** L. f. var. **Zeyheri** Burtt Davy
In drier parts of vlei behind homestead, 213.

C. **hirsutus** Sond.
Farm "Gaanspan," north of Blaauwberg, 245: between Zoutpan and Waterpoort. 258: farm "Eyem," north of Blaauwberg, 85. Reported to be a medicinal plant

C. **myriocarpus** Naud.
Along roadside, between Louis Trichardt and Pietersburg, 448.

5. **Coccinia Rehmannii** Cogn.
Climbing in *Salvadora*, *Lonchocarpus* belt, 40.

C. **sessilifolia** (Sond.) Cogn.
Farm "Eyem," north of Blaauwberg, 91.

177. CAMPANULACEAE.

1. **Lobelia decipiens** Sond.
In vlei behind homestead, fairly common, 214.

179. COMPOSITAE.

1. **Vernonia amygdalina** Del. (*V. Randii* Sp. Moore).

Along watercourse leading from kloof behind homestead; about 6–7 metres high, lounging, 116.

V. cinerascens Sch. Bip. (*V. Luederitziana* O. Hoffm.).

Between Zoutpan and Waterpoort: shrub, 60 100 cm. high, growing in exposed sandy soil, 249. First record of this species for the Transvaal.

[This plant has a wide distribution in Africa, occurring in Eritrea, Somaliland, Angola, Great Namaqualand and N. Transvaal. *V. Luederitziana* undoubtedly belongs to the same species. Our gathering differs from the Abyssinian plant only in having more robust and shorter peduncles (H.G.S.).]

V. fastigiata O. and H.

In low thorny scrub near *Catophractes* belt, 516.

2. **Ageratum conyzoides** L.

Along stream leading from large vlei, west of homestead, 227.

3. **Eupatorium africanum** O. and H.

Farm "Elsteg," about 6 miles west of Louis Trichardt, 342a.

4. **Aster luteus** (N.-E. Br.) Hutch. forma.

Between Zoutpan and Waterpoort, frequent in sandy soil, 256: Vivo, in sandy soil 656.

Our specimens are very similar to the typical form of *A. luteus* from northern Natal, differing from it in having blue ray-florets and slightly more pubescent achenes. The capitula of the Natal plants appear to be generally somewhat smaller. The wide range of material at the Transvaal Museum, however, seems to indicate that our specimens are merely forms of a variable species.

5. **Psiadia arabica** Jaub. and Spach.

Between Waterpoort and Wylie's Poort, 334.

6. **Nidorella resedifolia** DC.

In shade of trees near margin of pan, 495: between Zoutpan and Waterpoort, 272.

7. **Brachylaena sp.,** probably *B. transvaalensis* Phill. and Schw.

Farm "Elsteg," about 6 miles west of Louis Trichardt, 349.

8. **Blumea caffra** (DC.) O. Hoffm. (*B. natalensis* Sch. Bip.).

In open soil east of pan; heads globose; florets pinkish, 550.

B. lacera DC.

Farm "Elsteg," about 6 miles west of Louis Trichardt, 205.

9. **Pluchea leubnitziae** (O. Hoffm.) N. E. Br. (*Pechuelloeschea Leubnitziae* Hoffm.).

In *Catophractes* belt, north of pan, 55.

10. **Epaltes alata** Steetz.

In shade of trees near margin of pan, 501; north-east of pan, in grassland, 301.

11. **Helichrysum Kraussi** Sch. Bip.

Farm "Elsteg," about 6 miles west of Louis Trichardt, 345.

12. **Pegolettia senegalensis** Cass.

In open soil between stones near margin of pan, 502.

13. **Geigeria aspera** Harv. forma ?

Vivo, frequent in sandy soil, 651 : in sandy soil near *Catophractes* belt, 507 : between Zoutpan and Waterpoort, 273.

14. **Senecio polyanthemoides** Sch. Bip.

Scattered, in vlei behind homestead, 203.

S. transvaalensis Bolus

Between Louis Trichardt and Pietersburg; flowers pink, 674.

15. **Kleinia longiflora** DC.

East of pan among species of *Acacia*, 537.

16. **Berkheyopsis bechuanensis** Sp. Moore

Fairly frequent in very sandy area, about 3 miles west of pan, 638.

THE GENUS *ELYONURUS* Humb. and Bonpl. IN SOUTH AFRICA.

By E. P. Phillips, M.A., D.Sc. and H. C. Bredell, M.Sc.

SYSTEMATIC (By E. P. Phillips).

The genus *Elyonurus* in known by about twelve species recorded from South and North America, America, Australia, Arabia, Persia and Africa. In the year 1841 Nees described two species (*E. argenteus* and *E. thimodorus*) from the eastern and north-eastern districts of the Cape Province. Stapf in the "Flora Capensis" recognised only one species and reduced the second species to a variety *thymiodora*.

I recently had occasion to examine some fresh specimens collected near Pretoria and which did not conform to the description in the "Flora Capensis." As I suspected it to be different from the plant named *E. argenteus*, an examination of all the material in the National Herbarium was undertaken. The result of that examination is that I recognise three species as occurring in South Africa. The species *E. argenteus* Nees is common in the eastern and north-eastern areas of the Union; the plant typical of the western Transvaal and previously referred to *E. argenteus*, has been named *E. glaber*. It is characterised by the glabrous leaf-sheaths but a form with villous leaf-sheaths is met with and has been designated var. *villosus*. The third species (*E. pretoriensis*) I have only seen from Pretoria; it is characterised by having a *palea* present and the peduncled spikelet invariably bisexual.

Mr. C. E. Hubbard of the Kew Herbarium, to whom some specimens were referred, is not very convinced that the specimens are specifically distinct and due consideration has been given to his views. The distribution of the species as recognised in this paper is distinct; certain morphological characters are constant; the leaf-anatomy as detailed by Mr. Bredell is distinct. For the above reasons there appears every justification for separating the South African plants of *Elyonurus* into three species.

I am indebted to the director of the Royal Botanic Gardens, Kew, for sending me on loan, three herbarium sheets from the Kew Herbarium and to Mr. C. E. Hubbard for comments he made on specimens sent to him.

KEY TO SPECIES.

1. Pale, present in both spikelets as a hyaline scale; peduncled spikelet invariably bisexual.. 3. *pretoriensis*.

   Pale, absent in both spikelets, very rarely present; peduncled spikelets, male.. 2.

2. Sessile and peduncled spikelets of equal lengths; lower glume of sessile spikelet less than 1 cm. long, 2-toothed or with awns 1–2·25 mm. long, rarely longer.. 1. *argenteus*.

   Sessile spikelet longer than the peduncled spikelet; lower sessile glume of spikelet 1 cm. or more long, rarely shorter, with awns 4–6·5 cm. long, rarely shorter.. 3. *glaber*.

1. **E. argenteus** Nees

Plants 25–100 cm. high, forming dense clumps. Basal leaf-sheaths persistent, somewhat villous. *Blades* green, 10 27 cm. long, 0·5 mm. broad, usually somewhat curled, keeled so that leaf is almost 3-angled in cross-section, ciliate below, glabrous. *Culm* bearing inflorescence 2-noded, hairy at nodes. *Inflorescence* 3–8 cm. long. *Spikelets* of equal lengths. SESSILE SPIKELET. *Lower glume* 5·5–9·5 mm. long, 1·5–2 mm. broad, usually lanceolate, rarely ovate-lanceolate, acuminate, usually 2-toothed, more rarely produced into short awns 1–2·25 mm. long, with a dark band round the margins, with the margins narrowly inflexed and narrowly keeled, long ciliate on the keels, sometimes cilia from tubercules, usually 9-nerved, more rarely 5–7-nerved, villous on the back. *Upper glume* 4·5–7 mm. long, 1 1·5 mm. broad, lanceolate, acute, deeply concave, 3-nerved, keeled on back, shortly ciliate, pubescent on the back. *Lower valve* 3–5 mm. long, 0·75 mm. broad, lanceolate, acute, flattish on the back, 2-nerved, very rarely 3-nerved, ciliate above on hyaline marginal flaps. *Upper valve* 3 5 mm. long, 0·75 mm. broad, lanceolate, concave, 3-nerved, ciliate on hyaline marginal flaps. *Anthers* 3·5 mm. long, linear. *Ovary* ellipsoid; styles free; stigmas about twice as long as styles. *Lodicules* fan-shaped or triangular, truncate. PEDUNCLED SPIKELET. -*Peduncle* 2·5–4 mm. long, hollow, obtusely 3-angled, villous. *Lower glume* 3·5–7 mm. long, 1 1·75 mm. broad, lanceolate, long acuminate, sub-acuminate, 2-awned, 2-toothed, or with a small lateral tooth, with one margin narrowly inflexed and narrowly keeled, 5 7-nerved, more rarely 8 9-nerved, ciliate on the keel, with the cilia sometimes from tubercules, pilose or villous on the back. *Upper glume* 3·5–6·5 mm. long, 0·75–1·25 mm. broad, lanceolate, acute or sub-acute, deeply concave, rounded on the back, usually 3-nerved, rarely 4–5- or 7-nerved, keeled, ciliate on hyaline marginal flaps, usually shortly ciliate on keel, pubescent or shortly pilose on back, rarely glabrous. *Lower valve* 2·5–4 mm. long, 0·75–1·25 mm. broad, lanceolate, flattish on the back, 2-nerved, very rarely 3-nerved, ciliate on hyaline marginal flaps. *Upper valve* 3·5–4 mm. long, rarely shorter, 0·5–1 mm. broad, lanceolate, deeply concave, rounded on back, 3-nerved, ciliate on marginal hyaline flaps. *Pale*, a hyaline fimbriated scale (see only in one specimen). *Lodicules* fan-shaped or triangular, truncate. *E. thimiodorus Nees, Fl. Afr. Austr.*, 95; *E. argenteus var. thymiodora Stapf in Fl. Cap, vol. 7, p.* 333; *E. argenteus Nees ex Fl. Cap. l.c. partly.*

CAPE PROVINCE.—Humansdorp distr.: Witte Elsbosch, 750 ft., April, *Fourcade*, 2542. Albany distr.: Grahamstown, Oct., *Daly* and *Sole*, 108; Howison's Poort, 2,200 ft., Dec., *Galpin*, 3094; Trapp's Valley, Dec., *Daly*, 714. Kingwilliamstown distr.: Amatola Mountain, 4,000 ft., Dec., *Dyer*, 260; Kei Road, 2,000 ft., Febr., *Ranger*, 50. Stutterheim distr.: Blaney Junction, 1,200 ft., Jan., *Galpin*, 5622. Stockenstroom distr.: Katberg, Dec., *Sole*, 405. Queenstown distr.: Effingham Peak, Katberg, 5,700 ft., Dec., *Galpin*, 8393; Roode Rand farm, 3,550 ft., Nov., *Galpin*, 2510; Hangklip Mountain, 5,400 ft., Febr., *Galpin*, 5859. Komgha distr.: Near Komgha, 2,000 ft., Sept., *Flanagan*, 897. Kentani distr.: Near Kentani, 1,200 ft., Nov., *Pegler*, 1386. Tsolo distr.: Idutywa, 2,500 ft., Jan., *Schltr.*, 6273; Bazeia, *Baur*, 284. Barkly East distr.: Near Barkly East, Febr., *Greyvenstein*, 12. Mount Currie distr.: Hills round Kokstad, Nov., *Goossens*, 222; *Mogg*, 4826.

ORANGE FREE STATE. Ficksburg distr.: Riverhill Farm, high up on mountain slopes, Jan., *Potts in Grey Univ. Herb.*, 3706, 3721. Senekal distr.: Common on upper slopes of mountains near Doornkop, 5,300 ft., Dec., *Goossens*, 709; lava soil on top of mountain at Wonderkop, Dec., *Goossens*, 825.

BASUTOLAND.—Drakensbergen, *Stokoe in Nat. Herb.*, 8342; Thabuing, Jan., *Watt* and *Brandwyk in Nat. Herb.*, 8763; Leribe, *Dieterlen*, 177.

NATAL.—Pietermaritzburg distr.: Cedara, Dec., *Phillips in Nat. Herb.*, 20570. Lion's River distr.: St. Ives, Oct., *Mogg*, 5661; Balgowan, Nov., *Mogg*, 3541; near Howick, 3,600 ft., Nov., *Mogg*, 3502. Impendhle distr.: Giant's Castle, 8,000–9,000 ft., Oct.,

Wood, 10543. Estcourt distr.: Mont-aux-Sources, 10,000 ft., Feb., *Bayer* and *McClean*, 318; Dec., *Schweickerdt in Nat. Herb.*, 20573; Mooi River, Oct., *Mogg*, 3063, 3277. Bergville distr.: Mt. Twinta, Jan., *Doidge in Nat. Herb.*, 20571; Acton Homes, Jan., *Doidge in Nat. Herb.*, 20572.

TRANSVAAL.—Heidelberg distr.: Heidelberg, Dec., *Burtt Davy*, 3147. Standerton distr.: Near Standerton, Jan., *Burtt Davy*, 3083. Ermelo distr.: Near Ermelo, Jan., *Burtt Davy*, 952; Febr., *Henrici*, 1209. Carolina distr.: Vlei on town lands near Carolina, Jan., *Pellissier in Grey Univ. Coll. Herb.*, 4609; Dec., *Burtt Davy in Govt. Herb.*, 7364. Middelburg distr.: Botsabelo, Dec., *Fouche in Nat. Herb.*, 20574.

SWAZILAND.—Near Bremersdorp, *Burtt Davy*, 3018.

A specimen (*Rehmann*, 5672) collected at Houtbosch, in the Pietersburg district of the Transvaal is probably this species but the material is too poor for any examination.

2. **E. glaber** Phillips sp. nov. *Affinis E. argenteus sed foliis basin versus glaber differt. E. argenteus Nees ex Fl. Cap., vol. 7, p. 332 partly.*

Culmi 12–70 cm. alti. *Folia* 15–36 cm. longa, 2–3 mm. lata, carinata, basin versus glabra. *Racemi* 7–14 cm. longi, *Spiculae* sessiles hermaphroditae, 1–1·1 cm. longae. *Gluma* inferior, lanceolata, 6–8-nervata, profunde 2-fida, dense villosa. *Spiculae* pedunculatae 0·65–1 cm. longae. *Pedunculus* 2·5–4 cm. longus, villosus. *Gluma* inferior 6–9·5 mm. longa, lanceolata, acuminata vel profunde 2-fida, pilosa vel villosa.

BASUTOLAND.—Likhoele, March, *Dieterlen*, 1097.

ORANGE FREE STATE. Draaifontein (no precise locality), *Rehmann*, 3658. Senekal distr.: Near Senekal, Dec., *Goossens*, 956. Heilbron distr.: Heilbron, Jan., *Goossens*, 444. Hoopstad distr.: Wesselsbron, Jan., *Goossens*, 1243. Kroonstad distr.: Kroonstad, Sept., *Pont*, 198.

CAPE PROVINCE.—Vryburg distr.: Armoed's Vlakte, Febr., *Viljoen in Nat. Herb.*, 77; *Theiler in Nat. Herb.*, 20675; Klipvlakte, Nov., *Burtt Davy*, 11131.

TRANSVAAL.—Marico distr.: Derby Station, Nov., *Burtt Davy in Govt. Herb.*, 7168. Bloemhof distr.: Kameelpan, near Christiana, Jan., *Theron*, 628; Christiana, Mch., *Burtt Davy in Govt. Herb.*, 14126; Cawood's Hope, Mch., *Burtt Davy*, 12953. Wolmaransstad distr.: Boskuil, May, *Sutton*, 111. Ventersdorp distr.: Ventersdorp, Mch., *Pole Evans*, 3139. Potchefstroom distr.: Welverdiend Station, Mch., *Burtt Davy*, 11569. Johannesburg distr.: Turffontein, Mch., *Bryant*, D. 18; Johannesburg, July, *Hitchcock*, 21141. Pretoria distr.: Near Pretoria, Febr., *Skea*, 3, 71; *Liebenberg*, 3241 (typus), 3211; *Mogg in Nat. Herb.*, 20577; Onderstepoort, *Du Toit*, 28. Waterberg distr.: Springbok Flats, Oct., *Burtt Davy*, 7067.

Var. **villosus** Phillips, *Folia* basin versus pilosa vel villosa.

ORANGE FREE STATE.—Bothaville distr.: Bothaville, Jan., *Goossens*, 1182.

CAPE PROVINCE.—Kuruman distr.: Near Kuruman, Dec., *J. W. Mogg*, 7627.

TRANSVAAL.—Bloemhof distr.: Near Christiana, *Nelson*, 65. Vereeniging distr.: "Weltevrede," Dec., *Cronje*, 55. Johannesburg distr.: Johannesburg, *Moss*, 6852, (a hyaline pale was found in *Moss*, 6852); Elsburg, Jan., *Rogers*, 12135. Benoni distr.: Benoni, Sept., *Bradfield*, T.187. Pretoria distr.: Premier Mine, Oct., *Moss*, 5451; near Pretoria, Dec., *MacDonald in Govt. Herb.*, 5441; Hartebeestnek, Nov., *Burtt Davy*, 758; Wonderboom, near Pretoria, *Rehmann*, 4491.

Plants 42–70 cm. high, forming dense tufts; new shoots from nodes on a very short rhizome. Basal leaf-sheaths persistent, reddish, glabrous. *Blades* bright or dark green,

15–36 cm. long, 2–3 mm. broad (when fresh), keeled on back, with 5-6 nerves on either side of the mid-rib, ciliate at juncture with the sheath, otherwise glabrous. *Ligule* a narrow lacerated rim, about 0·5 mm. broad. *Culms* simple, rarely branched, 2–5-noded, with the nodes reddish and slightly swollen; upper internode 15–26 cm. long. *Inflorescence* 7–14 cm. long. *Sessile spikelet* longer than the peduncled spikelet, very rarely as long. SESSILE SPIKELET.—*Lower glume* 1–1·4 cm. long, rarely less than 1 cm. long, 0·15–0·175 cm. broad, lanceolate, usually acuminate, produced into two ciliate awns 4–6·5 mm. long, rarely shorter than 4 mm., with the margins narrowly inflexed, narrowly keeled and long ciliate on the keels, 6–8-nerved, villous on the back. *Upper glume* 5·5–7·5 mm. long, 0·1–0·125 cm. broad, lanceolate, usually subacuminate, acute, deeply concave, 3-nerved, keeled on the back, pilose, more rarely pubescent on the back. *Lower valve* 5–6 mm. long, 0·75–1·25 mm. broad, lanceolate, flattish on the back, 2-nerved, ciliate above on hyaline marginal flaps. *Upper valve* 4–4·75 mm. long, 0·75–1 mm. broad, lanceolate, concave, rounded on the back, 3-nerved, ciliate above on hyaline marginal flaps. *Anthers* 2·5–3·5 mm. long, linear. *Ovary* ellipsoid; styles free; stigmas twice as long as the styles. *Lodicules* fan-shaped or triangular, truncate, somewhat fleshy. PEDUNCLED SPIKELET. *Peduncle* 2·5–4 mm. long, hollow, villous. *Lower glume* 6–9·5 mm. long, 1–1·25 mm. broad, lanceolate, usually long acuminate, rarely 2-awned and then awns 1·5–3·5 mm. long, with one margin narrowly inflexed and narrowly keeled on same margin, rarely both margins narrowly keeled, 5-nerved, rarely 6-nerved, ciliate on the keel, pilose or villous on the back. *Upper glume* 5–8 mm. long, 0·75–1 mm. broad, lanceolate, acuminate, more rarely awned, concave, rounded on the back, 3-nerved, ciliate on hyaline marginal flaps, sparsely pilose on the back or pubescent with a few long hairs. *Lower valve* 5–6·5 mm. long, 0·75–1·25 mm. broad, lanceolate or linear-lanceolate, usually flattish on the back, more rarely slightly concave, 2-nerved, ciliate on hyaline marginal flaps. *Upper valve* 3·5–5 mm. long, 0·5–1 mm. broad, lanceolate, concave, rounded on back, 3-nerved, ciliate on upper margins. *Anthers* 2·75–3·5 mm. long, linear. *Lodicules* triangular or fan-shaped, truncate, somewhat fleshy.

Var. **villosa.** Leaf sheaths pilose or villous.

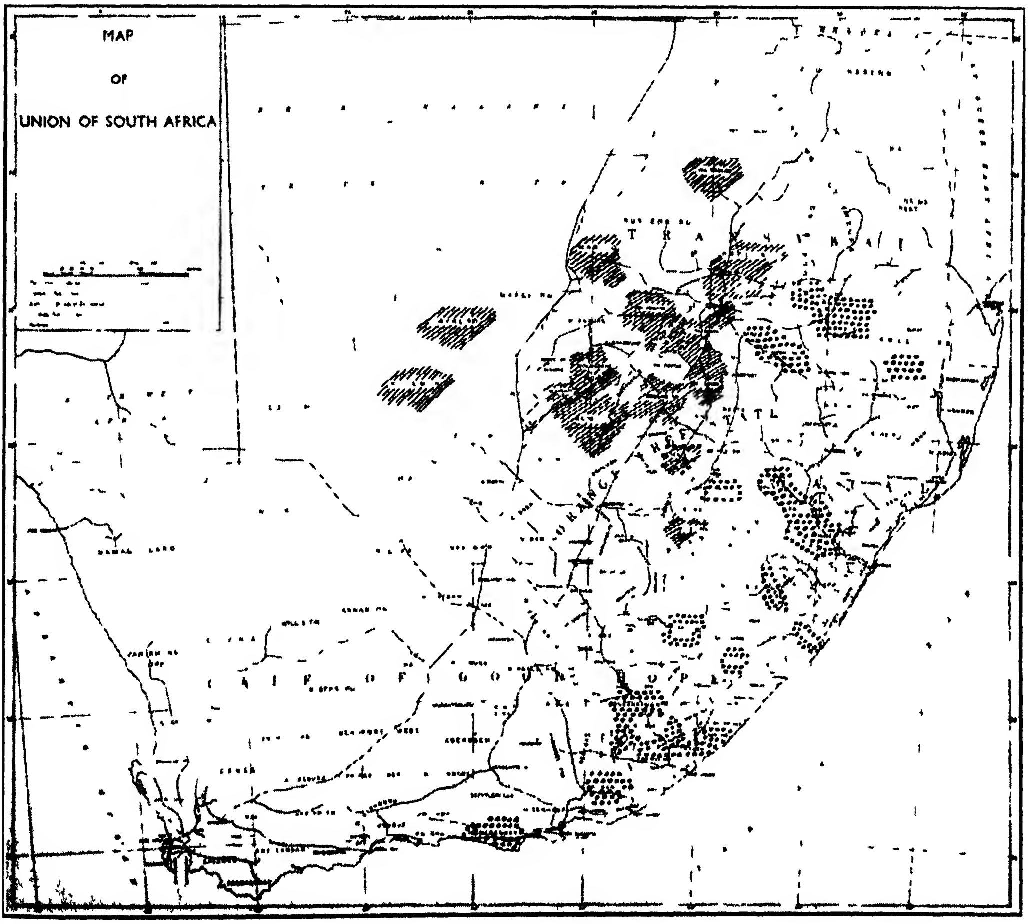
3. **E. pretoriensis** Phillips sp. nov. Affinis *E. argenteus* sed spiculus pedunculatis hermaphroditis differt.

Culmi ad 42 cm. alti. *Folia* ad 19 cm. longa, 3·5–4 mm. lata, carinata, basin versus ciliata, villosa; ligulae ad marginem breviter dense ciliatam redactae. *Racemi* 7·5–9·5 cm. longi. *Spiculae* sessiles hermaphroditae, 1·05–1·25 cm. longae. *Gluma* inferior, lanceolata, 6–9-nervata, profunde 2-fida, dense villosa. *Spiculae* pedunculatae hermaphroditae, 0·65–1 cm. longae. *Gluma* inferior, lanceolata, 5–9-nervata, acuminata, pilosa vel villosa. *Pedunculus* 1–3·5 mm. longus, villosus.

TRANSVAAL.—Pretoria distr.: Meintjes Kop, Pretoria, Oct., *Lansdell in Govt. Herb.*, 16066; near Pretoria, *Burtt Davy*, 726; Brooklyn, near Pretoria, *Mogg*, 12276; Zoo grounds, Pretoria, *Mogg in Nat. Herb.*, 20576 (typus).

Plants up to 42 cm. high, forming dense clumps. New shoots arising from nodes on a short rhizome with very short internodes. Basal leaf-sheaths persistent, slightly flushed with pink, keeled, ciliate, densely villous. *Blades* glaucous green, up to 19 cm. long, 3·5–4 mm. broad (when fresh), distinctly keeled on the back, with about 8 lateral nerves on either side of the mid-rib, ciliate on the basal portion, otherwise glabrous. *Ligule* a very narrow membranous rim, about 0·5 mm. broad, minutely lacerated. Culm bearing inflorescence 2-noded, rarely branched; nodes reddish, somewhat unequally swollen; upper internode 13–16 cm. long, glabrous. *Inflorescence* 7·5–9·5 cm. long. *Peduncled and sessile spikelets* of equal lengths or one or the other slightly longer. SESSILE SPIKELET.—*Lower glume* 1·05–1·25 cm. long, 0·175–0·225 cm. broad, lanceolate, more rarely ovate-lanceolate, produced into 2 awns 3·5–6·5 mm. long, with the margins narrowly inflexed, narrowly keeled, ciliate on the keels, usually densely villous, more rarely pilose on the back. *Upper* glume 6·5–7 mm. long, 1·25–2·25 mm. broad, lanceolate, acute, deeply concave, 3-nerved,

keeled on back, shortly ciliate on hyaline marginal flaps shortly pilose on the back, more rarely pubescent *Lower valve* 5–6 mm long, 1·25 mm broad, lanceolate, acute, flattish on the back, 2-nerved, shortly ciliate on hyaline marginal flaps *Upper valve* 4–5 mm long, 1 mm broad, lanceolate, concave, rounded on the back, 3–5 nerved minutely ciliate on hyaline marginal flaps *Pale* a hyaline fimbriated or ciliated scale 0·5–1 mm long *Anthers* 3 mm long, linear *Ovary* ellipsoid styles free stigmas twice as long as the styles *Lodicules* fan-shaped or quadrate truncate above PEDUNCLED SPIKELET *Peduncle* 1–3·5 mm long, hollow, villous *Lower glume* 0·65–1 cm long, 1·25–1·75 mm broad lanceolate, long acuminate, sometimes with a minute lateral tooth, with one margin narrowly inflexed and keeled, 5–9 nerved long ciliate on keel pilose or villous on back *Upper glume* 5–6·5 mm long, 1–1·25 mm broad, lanceolate, acute or sub-acute, deeply concave, rounded on the back, 3 nerved, ciliate on hyaline marginal flaps, sparsely pubescent or shortly pilose on the back *Lower valve* 2·5–5·5 mm long, 1 mm broad lanceolate, deeply concave, flattish on the back, 2 nerved, ciliate from hyaline marginal flaps *Upper valve* 2–5 mm. long, 1 mm broad, lanceolate, acute concave rounded on back, 3 nerved, ciliate on hyaline marginal flaps *Pale* 0·5–1 mm long, a hyaline ciliated or fimbriated scale *Ovary* ellipsoid styles free stigmas twice as long as the styles *Stamens* 2·25–3·5 mm long, linear *Lodicules* fan-shaped truncate



Distribution of *E. glaber* Phill. and *E. argenteus* Nees.

ANATOMICAL (By H. C. Bredell).

An examination of the anatomy of certain specimens was undertaken in order to find out whether anatomical characters would support the taxonomic characters on which the genus was divided into three species. The specimens examined were *Galpin*, 3094 (*E argenteus* Nees); *Mogg in National Herbarium*, 20576 (*E. pretoriensis* Phill.); and *Mogg in National Herbarium*, 20577 (*E. glaber* Phill.). Only the leaf and root anatomy of these grasses were examined.

E. PRETORIENSIS Phill.

Leaf Surface (Fig. 1).

The structure and arrangement of the epidermal cells can be studied when parts of the epidermis are torn from the underlying tissues and placed in water under the microscope. The abaxial or dorsal epidermis consists of long cells with intervening short cells opposite the parenchymatous tissues of the leaf. Opposite the primary and secondary veins, the cells differ in being more thick-walled, narrower, and of three types: (1) short rod-like cells; (2) medium-sized cells with the side walls constricted at the middle; and (3) elongated cells. The walls of all the long cells are undulated. On the adaxial or ventral surface only two types of cells can be distinguished, namely more or less elongated cells and short cells, the latter only being present opposite the primary and secondary vascular bundles. The cells on the adaxial surface are always shorter than corresponding cells on the abaxial surface, and the cell walls are only slightly or not at all undulated. On the abaxial surface the stomata develop in four rows, two near each leaf margin but on the adaxial surface they are distributed in two or more rows between the veins over the entire surface.

Leaf Anatomy (Fig. II).

In cross section the following tissues of the leaf can be distinguished: (*a*) the abaxial epidermis of closely packed regular cells with thickened outer tangential walls and which are usually small and much lignified opposite the mid-rib, the primary, and secondary veins; (*b*) the adaxial epidermis of regular, relatively thin-walled cells between which many stomata can be seen in cross section. The row of epidermal cells underlying the mid-rib are usually bigger and more thin-walled than the rest and act as motor cells, whereas those opposite the primary veins are smaller and thick-walled; (*c*) the ground tissue made up of thin-walled cells and in which lie (*d*), the vascular bundles. According to the extent of development, three types of vascular bundles can be distinguished, viz. the primary, secondary and tertiary bundles. The structure of the bundles is uniform throughout. All the primary bundles, except the mid-rib, have a sclerenchymatous tissue (stereome) developed towards the adaxial and abaxial surface. The secondary bundles are provided with an abaxial stereome only, whereas the tertiary bundles have no stereome associated with them. The stereome strands are very strongly developed and give the leaf a hard texture. The number of bundles usually averages 32, but in very broad-leaved specimens as many as 40 were found. Two or three tertiary bundles are present between the mid-rib and the first secondary bundles and 5–7 bundles between the mid-rib and first primary bundle.

Root Anatomy (Fig. III).

In cross section the following tissues can be distinguished: One layer of irregular more or less dome-shaped epiblem cells some of which grow out to form root hairs. Those cells usually disintegrate as soon as the root hairs die off only leaving remnants of some of

the cell walls in their place. Underlying the epiblem is the exodermis, which consists of one layer of more or less elongated cells with a marked tertiary thickening on the outer tangential walls. Underlying the exodermis are two or more rows of thick-walled cells which form a definite mechanical tissue, the sclerenchyma. The sclerenchyma surrounds and protects the inner thin-walled cortical layers (cortex). Adjoining the cortex on the inside is a single layer of well-differentiated cells, the endodermis which have a marked tertiary thickening on the inner tangential walls. Inside the endodermis are the vascular bundles with big vessels in the xylem and in the centre is the pith made up of thin-walled cells.

E. ARGENTEUS Nees

Leaf Surface (Fig. IV).

The structure and arrangement of the cells of the abaxial epidermis resemble that of *E. pretoriensis* (Fig. 1). On the adaxial surface the cells are irregular in outline and some of them bulge out to form an outgrowth on the outer tangential wall. Many hairs develop from this surface from between the relatively thin-walled cells.

Leaf Anatomy (Fig. V).

The structure of the leaf is very similar to that of *E. pretoriensis* (Fig. II). Two tertiary bundles are present between the mid-rib and the first secondary bundle and not more than five bundles are present between the mid-rib and the first primary bundle. The number of motor cells varies from 5–14 and the primary bundles are provided with a well-developed stereome which gives the leaf a hard texture.

Root Anatomy.

The structure of the root is the same as described under *E. pretoriensis* (Fig. III) but a sclerenchyma with slightly thick-walled cells is present in old roots only.

E. GLABER Phill.

Leaf Surface.

The arrangement of the epidermal cells on both abaxial and adaxial surfaces is similar to that of *E. pretoriensis.* On both surfaces the stomata are arranged in two or more rows between the veins and the cells are extremely thin-walled on the adaxial surface.

Leaf Anatomy (Fig. VI).

In cross section the same tissues are observed as in *E. pretoriensis* and *E. argenteus.* The cells of the abaxial surface differ from those of the adaxial surface in being more thick-walled on the outer tangential walls. One or two tertiary veins are present between the mid-rib and the first secondary vein and not more than six bundles are found between the mid-rib and the first primary vein. Usually 3 or 4 motor cells are present opposite the mid-rib. The cells of the sclenchymatous tissues are relatively thin-walled, with the exception of those opposite the mid-rib, and the leaf has a soft texture.

Root Anatomy (Fig. VII).

The cortical tissues, viz. epiblem, exodermis and cortex have thin-walled cells and a sclerenchymatous tissue is never differentiated.

Anatomically the three species of this genus differ in many respects. The anatomical differences which were found to be constant in the parts studied, are as follows :—

In *E. pretoriensis* and *E. argenteus* the stomata on the abaxial surface are usually arranged in four rows (two rows near each margin), whereas the stomata are arranged in

many rows between most of the veins in *E. glaber*. In *E. pretoriensis* the cells of the adaxial epidermis are relatively thick-walled; in *E. glaber* extremely thin-walled and irregular; and in *E. argenteus* thin-walled with some bulged out on the outer tangential walls. In *E. pretoriensis* and *E. argenteus* the motor cells seem to be restricted to the region of the epidermis underlying the mid-rib, but it is possible that all the big cells on the entire adaxial surface of *E. glaber* are motor cells because the leaves of this grass have the margins inrolled during hot days.

The space between the motor cells and the mid-rib is filled with parenchymatous tissue which appears to be different. In *E. pretoriensis* a group of cells consisting of two or three rows of cells is present, whereas only one row of cells is present in *E. argenteus* and *E. glaber*.

In *E. glaber* and *E. argenteus* one or two tertiary bundles are found between the mid-rib and the first secondary bundle, whereas the presence of two or three tertiary bundles is a fairly common feature in *E. pretoriensis*.

The structure of the vascular bundles is uniform throughout. The leaf texture in *E. pretoriensis* and *E. argenteus* is much harder than that of *E. glaber* owing to a much better developed stereome in the two former.

In the roots certain differences are apparent in the epiblem, exodermis and sclerenchyma. The epiblem cells of *E. argenteus* and *E. pretoriensis* are usually thick-walled and more or less persistent, whereas this layer is always relatively thin-walled in *E. glaber*. The tertiary thickening of the exodermis cells in *E. argenteus* and *E. pretoriensis* is an outstanding anatomical feature of these species. In *E. pretoriensis* the thickened exodermis is always associated with an adjoining tissue of well-differentiated sclerenchymatous cells and although this tissue may be distinguished from the adjoining tissues in *E. argenteus* in very old roots, it never forms a well-developed mechanical tissue. As a result of this lignification of the epiblem, exodermis, and underlying cortex cells, these cell layers are persistent throughout life and form a protecting sheath round the central cylinder which is always present in *E. argenteus* and *E. pretoriensis*, even though the thin-walled cortical cells may disintegrate. In *E. glaber* the exodermis remains relatively thin-walled throughout life and a well-differentiated sclerenchyma is never formed with the result that the cells of epiblem, exodermis and cortex usually break up at an early stage leaving the central cylinder unprotected or with a few crusts of dead cells round it.

The result of the examination is that the leaf and root anatomy of the South African species of *Elygonurus* may be used to determine the species. While it is probable that slight variations will be found under different environmental conditions, I am of opinion that the main anatomical features will remain constant for each species.

REFERENCE.

Goossens, A. P. and Theron, J. J. (1934): "An Anatomical Study of Themeda triandra," S. Afr. Journal Sc., Vol. XXXI.

Key to the species based on the leaf and root anatomy.

A_1 Leaves with two marginal rows of stomata on abaxial surface, hard in texture; cells of adaxial epidermis relatively thick-walled and more or less regular; roots with a tertiary thickened exodermis:

- a_1 Sclerenchyma well developed; some of adaxial epidermal cells bulged out.................................... *E. argenteus.*
- a_2 Sclerenchyma not very well developed; none of the cells of adaxial epidermis bulged out.......................... *E. pretoriensis.*

A_2 Leaves with many rows of stomata over the abaxial surface; soft in texture; cells of adaxial epidermis extremely thin-walled and irregular; exodermis not tertiary thickened................... *E. glaber.*

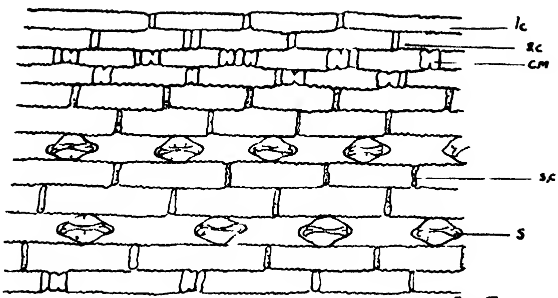
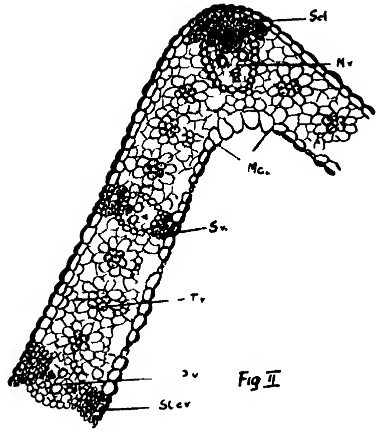


Fig I



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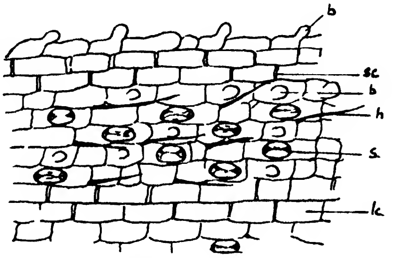


Fig IV

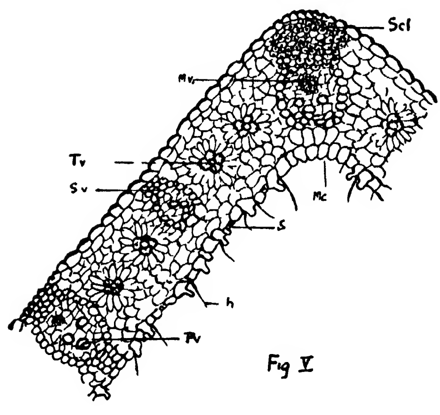


Fig V

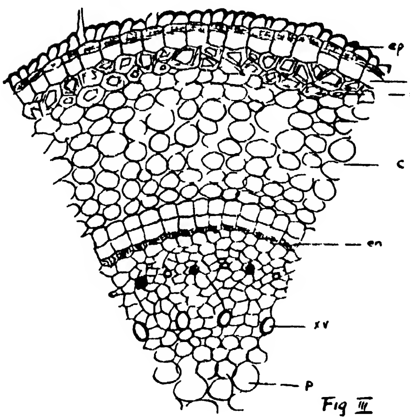


Fig III

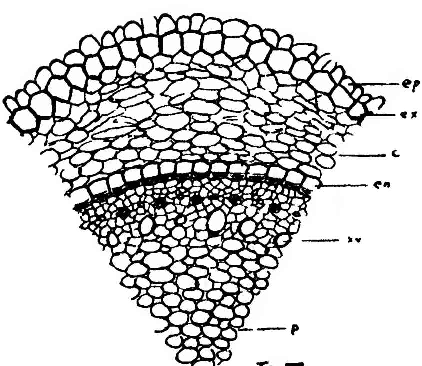


Fig VII

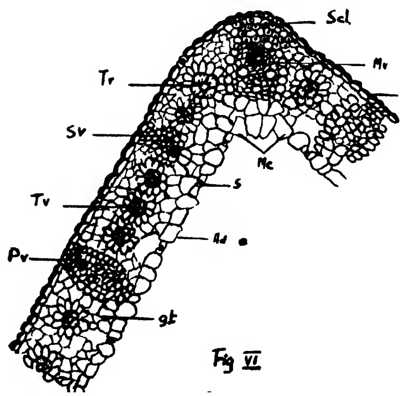


Fig VI

EXPLANATION OF FIGURES.

Fig. I: Surface view of abaxial epidermis of *E. pretoriensis*; *Fig. II:* T.S. of leaf of *E. pretoriensis*; *Fig. III:* T.S. of root of *E. pretoriensis*; *Fig. IV:* Surface view of adaxial epidermis of *E. argenteus* Nees; *Fig. V:* T.S. of leaf of *E. argenteus*; *Fig. VI:* T.S. of leaf of *E. glaber*; *Fig. VII:* T.S. of root of *E. glaber*.

Ab. e, abaxial epidermis; *Ad. e*, adaxial epidermis; *b*, epidermial cell bulged out on the outer tangential wall; *c*, cortex; *cm.*, cell constricted at middle; *en.*, endodermis; *ep.*, epiblem; ex., exodermis; *gt.*, ground tissue; *h.*, hair; *lc.*, long cell; *Mc.*, motor cells; *Mr.*, mid-rib; *p*, pith; *Pv.*, primary vein; *rc.*, rod-like cell; *s.*, stoma; *sc.*, short cell; *Scl.*, sclerenchyma; *ster.*, Sterome; *Sv.*, secondary vein; *Tv.*, tertiary vein.

A QUESTION OF NOMENCLATURE.

By E. P. Phillips, M.A., D.Sc.

I had occasion to examine a plant sent in for determination and in the National Herbarium found specimens of a similar plant filed away under three different genera. After looking into the matter I was able to settle the point by reference to literature and the specimens.

1. In 1915 Mrs. L. Bolus described a plant collected by the late Prof. Pearson as *Sutera rigida* L. Bolus (Ann. S.A. Mus., vol. 9, p. 267). She quoted *Pearson*, 3619 as one of the specimens of the species.

2. In 1922 (Hook. Ic. Pl., t. 3007), N. E. Brown described a new genus *Antherothamnus* and named the plants *A. Pearsonii* N. E. Br. *Pearson*, 3619 is one of the quoted specimens.

3. In 1928 (Sukkulentenforschung in Südwest-Afrika, p. 29) K. Dinter mentions a plant *Manuleopsis Karasmontana* Dtr. MS. He also distributed specimens (*Dinter*, 5088) under that name.

Mrs. L. Bolus was good enough to lend me a sheet of *Pearson* 3619 and it was found to be the same plant as *Dinter* 5088. The species must then be :—

Antherothamnus rigida (L. Bolus) N. E. Br. *Sutera rigida L. Bolus ; Manuleopsis Karasmontana Dinter nomen nudum.*

South West Africa.—Great Karasberg: Krai Kluft Ravine, *Pearson*, 8284. Great Namaqualand: Warmbad, *Pearson*, 4377. Bushmanland: Groot Rozynbosch, *Pearson*, 3619. Klein Karas: *Dinter*, 5088.

Transvaal.—Potgietersrust distr.: Farm "Swerwerskraal," about 35 miles west of Potgietersrust, *Rowland in Nat. Herb.*, 8792.

NEWLY DESCRIBED SPECIES.

Crassula sessilicymula *Mogg*, sp. nov. (Crassulaceae); affinis *C. corymbulosae* Link. petalis erectis, cymulis constanter sessilibus, et foliis cautinis differt.

Herba perennis, 30–75 cm. alta, singulis caulibus ex base rhizomate. *Caules* 0·75 cm. diametro, basi ramosi, fulvi aut colores lateris infra, supra virides glanduloso-pubescentes; internodia 0·5–2·5 cm. longa. *Folia* sub-deccussata, sessilia, semi-perfoliata, horizontalia, simplicia; inferiora 2·4 cm. longa, 1 cm. lata, 0·3 cm. crassa, utcunque 3 cm. × 0·7 cm. × 0·1 cm. caulis media parte, et ad apice diminuendo, ovata vel lanceolata, acuminata, glabraque non reticulata, glanduloso-ciliata. *Infloresentia* cymosa. *Cymulae* subcapitatae, numerosae, axillares, ad summum caulis laxae dispositae. *Flores* 2–6, fasciculati, subsessiles. *Calyx* 2 mm. longus; lobi infra breve connati aliquando liberi, 1·5 mm. longi, angusto-acuminati, pilosi, glanduloso-ciliati. *Corolla* alba; petala infra connata, 3 mm. longa, ovato-oblonga, infra ventra concava, apice patentia et infra apicem dorso mucronulata. *Stamina* petalis subaequalia, ad tubum corollae affixa; filamenta subulata, basi lata; antherae ovatae. *Carpella* staminibus aequalia; ovarium oblique-ovatum; stylus distinctus. *Squamae* parvae, aurantiacae, pyriformes, emarginatae.

Transvaal.—Pretoria distr.: Farm "Klipdrift," near Hammanskraal, 28 miles north of Pretoria, in a donga inhabitated by thorn-scrub and succulents, *Mogg*, 12503 (type); between the Saltpan and Hammanskraal, 32 miles N.W. of Pretoria, banks of a dry river-course beneath a bush of *Acacia litakunensis* Burch., *Mogg*, 12505; farm "Zeekoegat," beneath bush-groups, *Mogg*, 14091; *Vogts in National Herbarium*, 13049; farm "Rooikop," *Smuts* and *Gillett*, 2511. Waterberg distr.: Naboomspruit, farm "Mosdene," under tree clumps in shade, *Galpin*, M 120 A; Seringa, *Galpin*, 8479; farm "Gannabosch," *Bailey in Colonial Govt. Herb.*, 80. Potgietersrust distr.: Potgietersrust, farm "Riebeek West," *Steyn*, 85.

The species is also allied to *C. compacta* Schönl., but the leaves are not all rosulare, and to *C. Lettyae* Phill. from which it differs in the well-developed leaves which subtend the cymules and the glandular-ciliate hairs of the leaf-margins.

Brachystelma nigrum *R. A. Dyer*, sp. nov. (Asclepiadeae-Ceropegieae); affinis B. Gerrardo Harv. floribus majoribus calycis lobis superne lineari-lanceolatis corollae indumento coronae interioris lobis brevioribus differt.

Herba perennis. *Caules* erecti, simplex vel non nunquam ramosi, 30–40 cm. alti, 2·5–4 mm. crassi, foliosi, subhispidi, internodiis 3–5 cm. longis apicem versus brevioribus. *Folia* breviter petiolata, late ovata, cordata, obtusa vel subacuta, 2·5–4·5 cm. longa, 2–4 cm. lata, juniora minus, infra prominente nervosa, utrinque pilis paucis induta, nerviis et margine hispidis; petioli 2–5 mm. longi, subhispidi, basi stipulis 2 minimis conicis ornati. *Flores* axillares nodiis solitarii; pedicelli graciles, circiter 2 cm. longi, basi 1-bracteati; bractea oblanceolato-linearis vel ovato-elliptica, circiter 1·5 cm. longa, breviter petiolulata. *Calycis* segmenta plus minusve 7 mm. longa, basin versus breviter ovata, submembranacea, superne lineari-lanceolata, concava, extra pubescentia, intra basi disco coroniforme minutissime lobato ornata. *Corolla* nigra; tubus breviter et latissime campanulatus, glaber; lobi 7 mm. longi, 3 mm. lati, infra medium constricti, subpanduriformes, elegantissime inflexo-ciliati, supra medium elliptici, subcrassi, dorso concavi, hispiduli, intra nigro-velutini, apice leviter incurvi, pilis paucis longis inflexis induti. *Coronae* exterioris lobi circiter 0·5 mm. longi, bifidi, breviter lanati; coronae interioris lobi lineares incumbenti-conniventes.

NATAL.—Vryheid, among rocks on summit of Lancaster Hill, locally frequent, flower black, Jan., *Galpin*, 10211.

This is yet another new species to the credit of Dr. Ernest Galpin who collected the specimens near Vryheid, Natal, in January, 1930. He recorded the colour of the fresh flowers as black and this is the derivation of the specific epithet. *Brachystelma nigrum* is closely allied to *B. Gerrardi* Harv. (Harv. Thes. Cap. 2: 61, t. 196) and is distinguished from this mainly by the smaller size of the flowers, the shape of the upper portion of the calyx segments and the pubescence of the corolla. The lobes are shortly, although not densely, pubescent on the outer surface and shortly woolly pubescent on the inner surface. The colour of the flower of *B. Gerrardi* is given as " bright metallic green " on the inner face.

An interesting character noted by Bullock when describing *Ceropegia filicalyx* in Hook. Icon. Plant. under t. 3219 (1933), namely " intersepaline glands " has an equivalent structure in both *B. Gerrardi* and *B. nigrum.* These have a minute lobed disc or corona-like structure attached to the base of the calyx round the base of the corolla-tube. Through the courtesy of the Mycologist in Charge of the Natal Herbarium, Durban, I have examined one calyx of *B. Gerrardi* (Wood, No. 1607) but herbarium material of this species and of *B. nigrum* is insufficient for a comprehensive study of the intercalycine corona-like organ.

A duplicate of Galpin 10211 is in the herbarium of the Royal Botanic Gardens, Kew.

Riocreuxia aberrans *R. A. Dyer*, sp. nov. (Asclepiadeae-Ceropegieae); corollae tubo breviter campanulato valde distincta.

Herba perennis caulibus numerosis. *Caules* erecti vel volubiles circiter 60 cm. alti vel altiores, plus minusve ramosi, pilis uniseriatis induti, internodiis 4–5 cm. longis, nodiis ciliatis. *Folia* patentia, petiolata, reniformi-ovata, circiter 5 cm. longa et lata vel interdum usque 7 cm. longa, basi profunde cordata, apice acuminata, utrinque glabrescentia, margine ciliata; petioli 2–4 cm. longi supra pilosi. *Flores* plures in cymis extra-axillaribus alternantibus, breviter racemosae pedicellis filiformibus. *Calycis* segmenta lineari-lanceolata, glabra, 4 mm. longa. *Corolla* glabra; tubus campanulatus, 5 mm. longus, circiter 6 mm. diametro; lobi lanceolato-lineares, 1·3–1·5 cm. longi, apice coherentes facile liberati. *Corona* exteriora et interiora confluentes; coronae exteriorae lobi brevissimi, bipartiti, coronae interiorae lobi erecti, oblongo-lineares, obtusi vel emarginati, 2 mm. longi, gynostegium multo superanti.

TRANSVAAL.—Ermelo distr.: On farm " The Gem," Dec., *Walker in Nat. Herb.*, 14397 (type). Belfast distr.: Dullstroom, on farm " Paardeplaats," 7,000 ft., local on low, dry ridge of barren white quartzite, bush 2 ft. high, Jan., *Galpin*, 13302 (fruit).

Although the specimen *Galpin*, 13302 is in fruit and has no flowers, it resembles the type so closely in vegetative characters, that I have little doubt that it is the same species. The type material was collected in flower in December and the fruiting specimen in January, which is consistent with seasonal development. Further the leaves of the fruiting specimen are coarser and slightly larger, up to 7 cm. long and broad, the maximum figure given in the above description. The follicles of the Galpin specimen are up to 10 cm. long and are slightly constricted at intervals of 6–7 mm.

Riocreuxia aberrans differs markedly from all others in the genus (hence the name) by the short *campanulate* tube, whereas the usual form is cylindric. At first sight there appears to be only one corona, owing to the very small bilobed outer corona lobes fusing at the base with the inner ones, the lobes of the outer ones having the appearance of basal expansions of the inner ones.

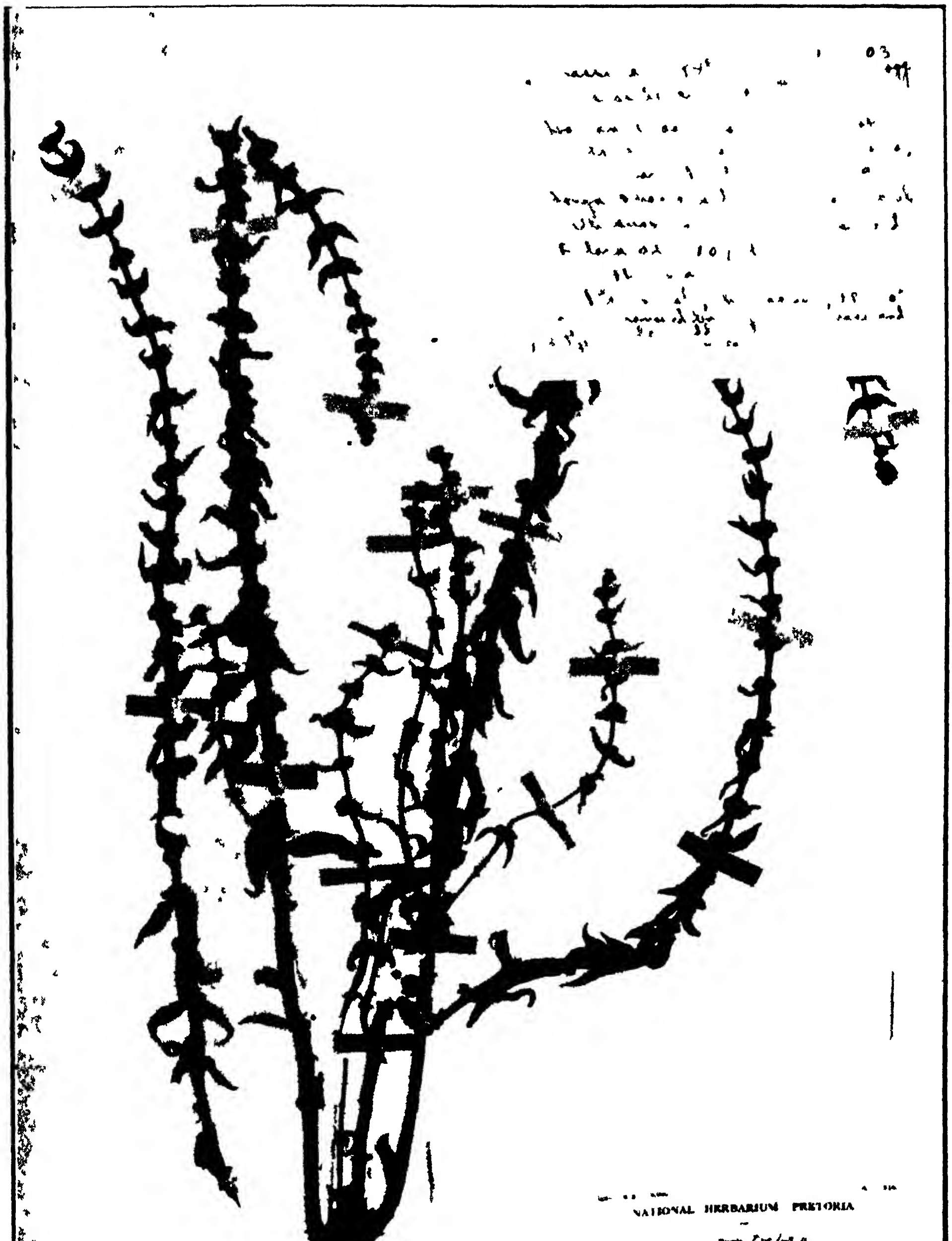
Another question which requires further investigation is whether the corolla lobes remain attached at the tips when the flowers open normally. Most of the open flowers on the type have the corolla lobes free, but this may have been caused during the preparation of the specimen. If, on the other hand, it is the normal habit of the species, it constitutes a second important difference in this species from the generic characters of *Riocreuxia*, the other being the comparatively short campanulate tube. Together, these differences would be sufficient reason for placing it in a separate genus.

Leucadendron elimense Phillips (Proteaceae Proteae); affinis *L. concolori*; sed foliis glabris differt.

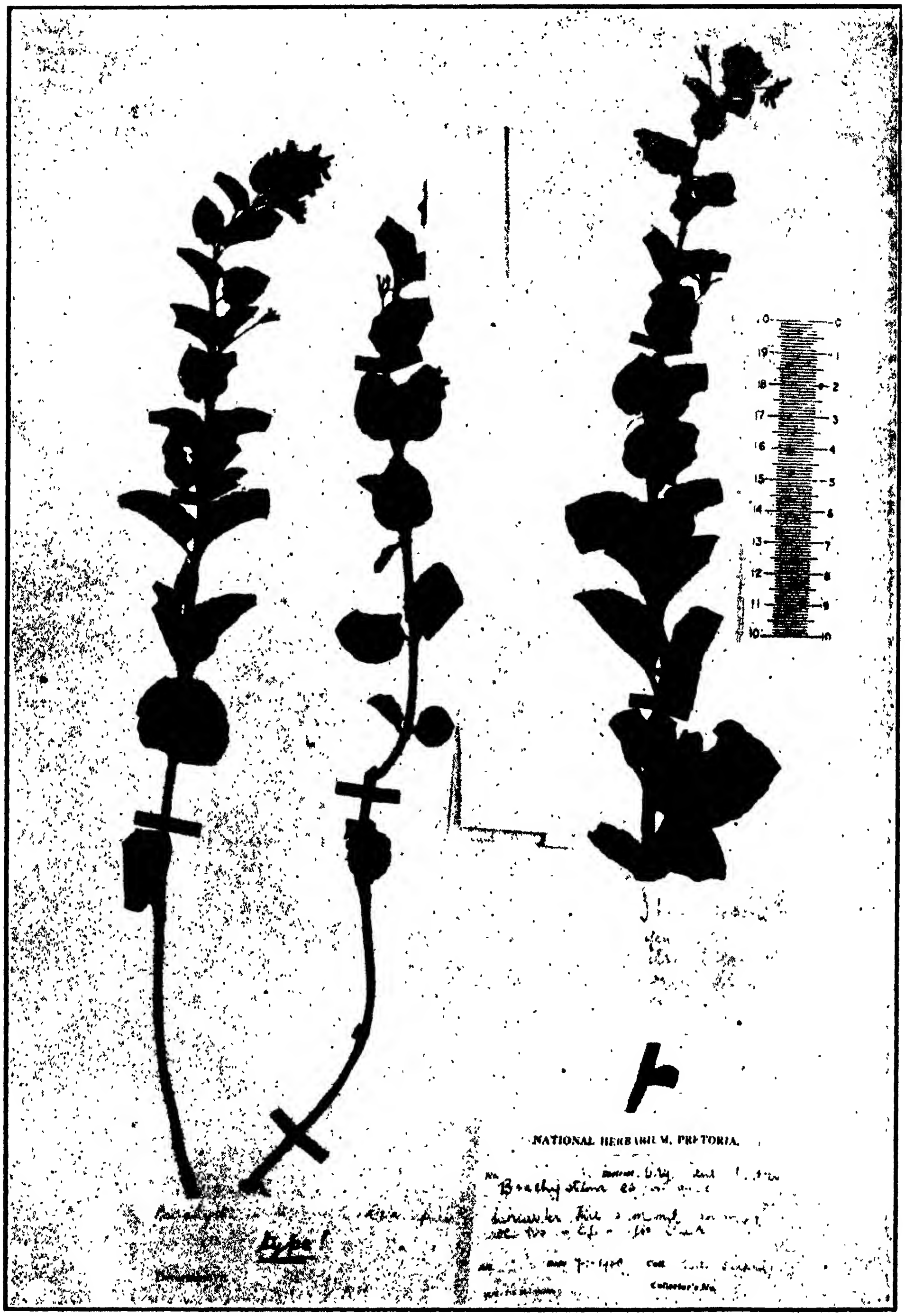
Suffrutex; ramuli dense pubescentes. *Folia* 2·5-3 cm. longa, 0·8–1·1 cm. lata, lanceolata, apice obtusa, glabra. *Inflorescentia* ♂ 2·7 cm. lata. *Receptaculum* 2 cm. longum, 5 mm. latum, oblongum. *Bracteae* 1 cm. longae, 1 mm. latae, lineares, apice subacutae, carinatae, supra pubescentes. *Perianthii tubus* 1·1 cm. longus, cylindricus, glaber; segmenta 2 mm. longa, linearia, sparsim pilosa; lobi 4 mm. longi, lineares, apice obtusi, glabri. *Antherae* 3·5 mm. longae, lineares. *Stylus* 1·7 cm. longus. *Inflorescentia* ♀ 2 cm. lata, subglobosa. *Receptaculum* 1·3 cm. longum, 5mm. latum, oblongum. *Bracteae* 8 mm. longae, 4·5 mm. latae, apice plus minusve obtusae, infra pilosae. *Perianthii tubus* 8 mm. longus, planus, pilosus; segmenta 2 mm. longa, linearia; lobi 1·5 mm. longi, oblongi, apice obtusi. *Ovarium* 1·5 mm. longum, ellipticum, pilosum; stylus 1·5 cm. longus, glaber; stigma paullo expansum, semi-obliquum.

Cape Province.—Caledon distr.: Koegelberg, alt. 3,500 ft., *Stokoe in National Herbarium*, 21906.

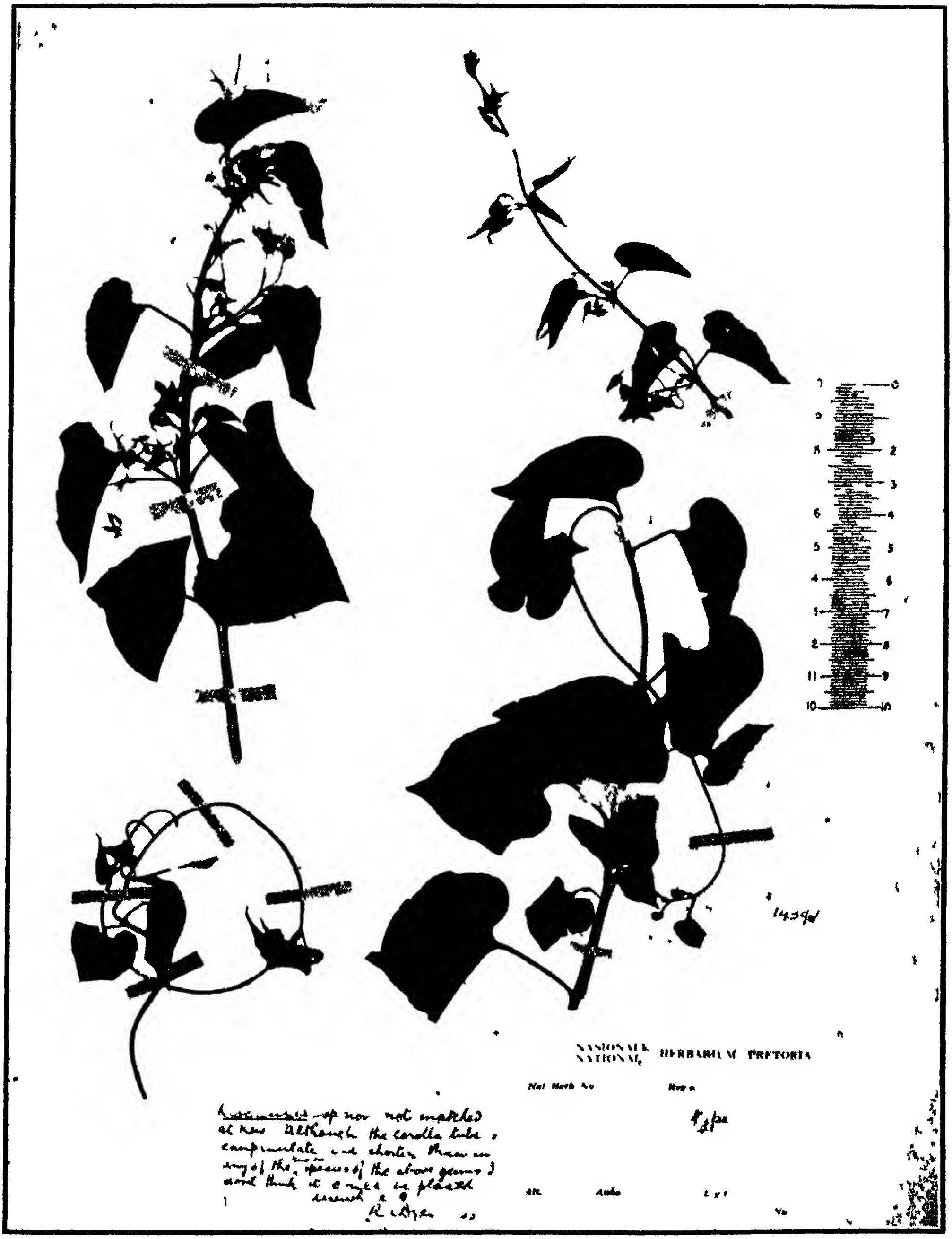
The species resembles *L. concolor* R. Br. but the leaves are not densely villous along the margins. The female heads are surrounded by ovate ciliate glabrous bracts, and both the male and female heads are surrounded by leaves, similar to the stem leaves, but larger and yellow and with red tips, longer than the heads.



Crassula sessilicymula Mogg



Brachystelma nigrum R. A. Dyer



Riocreuxia aberrans R A Dyer

CONTENTS.

THE USTILAGINALES OF SOUTH AFRICA.

George Lorenzo Ingram Zundel,

Assistant Professor, Plant Pathology, Extension,

The Pennsylvania State College.

The following paper is an attempt to monograph partially the smuts or Ustilaginales of South Africa and adjacent territories. Besides species found wholly within the Union of South Africa, there are included species from South West Africa, Portuguese East Africa, the Tanganyika Territory, Rhodesia and Nyassaland Protectorate.

Original descriptions of South African smuts are to be found in various publications, principally German. Paul Hennings and later the Sydows have described most of the new species found in South Africa. Recently the author has described new species of South African smuts.

In 1926, Len Verwoerd of the University of Stellenbosch made the first attempt at monographing South African smuts. It is the hope of the writer that sometime in the future he will be able to enlarge and complete the present paper as more specimens are collected and become available. Specimens used for descriptions in the present paper are mostly from the Mycological Herbarium, Union Department of Agriculture. Many type specimens of species described herein were not available for examination, in fact the writer has not been able to locate the type specimens of some of the very early South African collections.

Acknowledgment and thanks are hereby made to the Director of the Royal Botanic Gardens, Kew, Surrey, England, for supplying type material of *Tilletia Ayresii* Berk. for study; to Miss Claribel Barnett, Librarian, and Mr. J. A. Stevenson, Mycologist, both of the United States Department of Agriculture for furnishing original descriptions of some of the species and for the loan of books; to Dr. George Perkins Clinton for the loan of type specimens from his personal herbarium. The genus descriptions have followed very closely, in some cases verbatim, those previously published by Dr. Clinton. Dr. Robert E. Dengler, Professor of Classical Languages, The Pennsylvania State College, has kindly written the Latin descriptions of new species. The host identification and nomenclature have been revised according to the latest usage by Miss L. Chippendall of the South African National Herbarium, Pretoria.

The asterisk (*) after a host plant name or locality indicates that the record has been secured from literature and that no specimen has been seen.

CHARACTERIZATION OF THE USTILAGINALES.

This group of fungi belongs to the sub-group Hemibasidiomycetes with the single order Ustilaginales containing two families: (1) Ustilaginaceae, and (2) Tilletiaceae.

The Ustilaginales consist of nearly 600 species. All of them are obligate parasites usually attacking herbaceous plants. The mycelium is internal, slender, hyaline, somewhat septate and branched. It is either uninucleate, binucleate or occasionally multinucleate.

The hyphae are usually intercellular with capitate or racemoid haustoria penetrating the host cells for food. Most of the smuts attacking cereals, however, have intercellular mycelium without haustoria and obtain food direct from the host cells by the process of osmosis. A third class of smut fungi, e.g. *Ustilago Zeae*, has mycelium that penetrates the individual host cells causing death.

At maturity the hyphae enter certain organs of the host and form thick celled chlamydospores which are the common smut spores or winter spores. These are produced singly, in pairs or in balls, usually forming a dark powder at maturity. In the genera *Entyloma*, *Tracya*, *Burrillia*, and *Doassansia*, however, the spores are produced within the host tissues and are light coloured. In the early stages of development, all of the spores are binucleate. At maturity each spore is uninucleate but is produced from a binucleate hypha. Each mature spore has a thin endospore and a thicker variously colored and sculptured exospore. At maturity the spore masses produce various effects on the host, e.g. a shredding of the leaves of the host; a destruction of the inflorescence; the replacing of the pollen by smut spores and the utilization of the pollen distributing apparatus for the distribution of smut spores; stimulating the development of staminoids in pistillate flowers; the formation of boils or gall-like tumor growths; the destruction of the seed, etc.

Usually the mycelium is annual, however, in some cases it is perennial and hibernates in the roots of the host.

The Ustilaginales are divided into two families based on the method of producing the promycelium and basidiospores. In both families, previous to the production of a promycelium, the nucleus divides and one of the daughter nuclei leaves the interior of the spore and migrates into the promycelium.

The first family is the Ustilaginaceae. Here the daughter nucleus in the primary promycelium divides twice forming four nuclei. Following these divisions three septa, or cross walls, are formed thus forming a four celled promycelium. Basidiospores are produced laterally at the cross walls. As the basidiospores are formed, the nucleus in the promycelial cell divides and one migrates into the basidiospore. This process continues as long as basidiospores are produced. The infection tubes are produced by the basidiospores.

The second family is the Tilletiaceae. As the promycelium develops, one of the daughter nuclei together with some of the protoplasm migrates from the interior of the germinating spore into the base of the young aseptate promycelium. This is followed by at least four and sometimes more nuclear divisions, thus forming at least eight nuclei which together with the protoplasm migrate to the distal end of the mature promycelium. The lower empty part of the promycelium is then cut off by three septa. Eight basidiospores are then produced terminally and usually conjugate before separation from the promycelium.

Conjugation seems to be necessary in order for the smut fungus to infect its host plant, i.e. there are apparently basidiospores and promycelium cells with two genders. The conjugation process may take place in any of the following ways:-

(1) A basidiospore may conjugate with another basidiospore.

(2) A basidiospore may conjugate with a cell of a promycelium.

(3) A promycelium cell may conjugate with another promycelial cell.

(4) Occasionally two promycelia are produced from one smut spore and promycelial cells of one promycelium may conjugate with cells of the other promycelium.

Infection tubes are produced by the conjugated parts of the basidiospores or promycelia. There are three principal types of infection :—

Type 1. The chlamydospores attach themselves to the seed of the host and do not grow until the host seed germinates. In this manner there is a seedling infection. The germ tube penetrates the tissues of the entire host plant.

Type 2. The chlamydospores attach themselves to the stigma of the flower of the host, where they germinate at once, sending mycelial threads down the style into the young ovary where the mycelium becomes dormant without deforming the seed, and resting there until favorable conditions for seed germination arrive. As the seed germinates and grows, the dormant hibernating mycelium becomes active and penetrates the entire host tissue, finally replacing the inflorescence with smut spores.

Type 3. In this type the chlamydospores produce promycelia and basidiospores in decaying vegetation. The basidiospores are then carried by the wind to the young host plants where local infection takes place. The mycelium penetrates the host cells only locally.

During the short time of basidiospore formation, the smuts are facultative saprophytes forming colonies of yeast-like sporidia. Most of them can be cultivated on nutrient agar but few if any can complete their life history on artificial media.

CLASSIFICATION OF THE USTILAGINALES.

The Ustilaginales are parasitic fungi that attack various parts of herbaceous plants. Infection nearly always takes place through very young tissues, either through germinating seed or other special parts of the host. This group can usually best be recognized by the sooty mass of spores that are produced, singly, in pairs, or as spore balls. The black smuts are represented by such genera as *Ustilago*, *Sphacelotheca*, *Sorosporium*, *Urocystis* and *Tilletia*, while the so-called white smuts are mostly leaf inhabiting and are included in such genera as *Burrillia*, *Doassansia*, *Entyloma* and *Tracya*.

Two families are included in the order Ustilaginales, (1) the Ustilaginaceae, and (2) the Tilletiaceae. They are separated by the manner in which the promycelium and sporidia are produced as follows :—

Promycelium usually with lateral sporidia at septa... Ustilaginaceae.
Promycelium with clustered terminal sporidia......... Tilletiaceae.

In the classification of the smut fungi the viewpoint is held that morphological characters rather than host susceptibility or the use of biometry must be the basis for determining species. The concept of species as used in this paper is very broad. Many recently described species are merely physiological or pathological strains that have adapted themselves to specific hosts. Such species should be relegated to synonymy.

Within the last few years technique has been perfected whereby it is now possible to hybridize the smut fungi and thus study gender and species relationship as is done in the higher plants. Extensive work of this nature has been done by workers in the United States Department of Agriculture and of the several state Agriculture Experiment Stations, also by workers in Canada and Wales. A brief summary of a few of the numerous papers follows :—

Reed[1] in 1928 reported four physiological races of *Tilletia laevis* and six physiological races of *Tilletia Tritici*. Each physiological race varied in its ability to attack different varieties or even strains within a given variety of wheat.

Flor[2] working in Washington State reported in 1932 that *Tilletia Tritici* and *Tilletia laevis* were heterothallic. He also reported that he hybridized *Tilletia Tritici* and *Tilletia laevis* and had obtained evidence that hybridization occurred in nature. Examination of over 10,000 bunted heads revealed that there were all degrees of reticulations on spore

[1] Reed, George M. Physiological races of wheat bunt. Am. Jour. Bot. **15** : 157–170. 1928.

[2] Flor, H. H. Heterothallism and hybridization in *Tilletia Tritici* and *T. laevis*. Jour. Agr. Res. **44** : 49–58. 1932.

of *Tilletia Tritici*. In some cases the reticulations were so fine that it was almost impossible to see them ; on the other hand the reticulations were so coarse that they appeared almost spiny.

In 1921, Faris[3] showed that there was physiological specialization of *Ustilago Hordei* and that each physiologic form attacks only certain specific varieties of barley.

Holton[4] in 1932, reported that he had hybridized *Ustilago Avenae* and *Ustilago levis*. He found that factors such as echinulation of spores, growth of the fungi in artificial culture, appearance of the smut in the panicle, all followed in general a Mendelian ratio and furthermore a buff colored smut with hyaline spores was produced by crossing monosporidial lines hybrid chlamydospores. Later he found[5] that the buff smut resulted from a mutation in *Ustilago levis*. He further found that pathologic strains of *U. Avenae and U. levis* were produced by hybridization and segregation.

In a more recent paper,[6] Holton reported that when *U. Avenae* and *U. levis* were hybridized that (1) the factor for brown is dominant over the factor for hyaline chlamydospores ; (2) the factor for echinulate spore walls is dominant over the factor for smooth spore walls and that these characters generally segregate in a Mendelian ratio.

Reed and Stanton[7] in 1936, reported that a distinct strain of loose smut (*U. Avenae*) occurs on Red Rustproof oats. This strain of smut also attacks various strains of *Avena fatua* and *Avena strigosa*, also the variety Canadian (a variety of *Avena sativa*).

Rodenhiser[8] working with *Sphacelotheca Sorghi* and *Sphacelotheca cruenta* found physiologic forms in both species. He produced an intermediate type of smut by hybridizing *S. Sorghi* and *S. cruenta* which had a sorus different from either parent with two kinds of sterile cells, the small sterile cells of *S. Sorghi* and the large spherical type of *S. cruenta*. In culture, numerous mutants were observed to arise. It was possible for him to produce new physiologic forms by hybridization and segregation.

In view of these results it seems that H. Sydow[9] in 1924, when he made a study of *Cintractia Caricis* (Pers.) P. Magn. on *Carex* spp., and finally described ten new species based on host species, had in reality only ten physiologic forms of *Cintractia Caricis* (Pers.) P. Magn. that by natural hybridization and segregation were pathologic to specific species of *Carex*.

Likewise Liro[10] in 1924 in his study of the smuts attacking *Polygonum* spp. and Ciferri[11] in 1928, in his new sub-species of *Entyloma compositarum* Farlow are dealing with physiological forms.

Fisher[12] has recently reported the natural infection of *Agropyron tenerum* in central Washington by *Tilletia Tritici* and notes that the size of the sorus varies with the size of the ovary of the host. In other words, the morphology of the fungus varies with the host.

[3] Faris, James A. Physiologic specialization of *Ustilago Hordei*. Phytopath. **14** : 537–557. 1924.

[4] Holton, C. S. Studies in the genetics and the cytology of *Ustilago Avenae* and *Ustilago levis*. Univ. Minn. Exp. Sta. Tech. Bull. **87** : 1–34. 1932.

[5] Holton, C. S. Origin and production of morphologic and pathologic strains of the oat smut fungi by mutation and hybridization. Jour. Agr. Res. **52** : 311–317. 1936.

[6] Holton, C. S. Inheritance of chlamydospore characters in oat smut fungi. Jour. Agr. Res. **52** : 535–540. 1936.

[7] Reed, George M. and Stanton, T. R. Reaction of oat varieties to physiologic races of loose and covered smuts of red oats. Jour. Agr. Res. **52** : 1–15. 1936.

[8] Rodenhiser, H. A. Studies on the possible origin of physiologic forms of *Sphacelotheca Sorghi* and *S. cruenta*. Jour. Agr. Res **49** : 1069–1086. 1934.

[9] Sydow, H. Notizen über Ustilagineen. Ann. Myc. **22** : 277–291. 1924.

[10] Liro, I. J. Die Ustilagineen Finlands. I. Ann. Acad. Sci. Fenn. A. **17** : XVIII—636 pp. 1924.

[11] Ciferri, R. Quarta contribuzione allo studio Ustilaginales. Ann. Myc. **26** : 1–68. 1928.

[12] Fischer, George W. The susceptibility of certain wild grasses to *Tilletia Tritici* and *Tilletia laevis*. Phytopath. **26** : 876–886. 1936.

KEY TO GENERA OF USTILAGINALES REPORTED FROM SOUTH AFRICA.

I. Spores single :—

A.—Usually forming a dusty sorus at maturity—

1. Large, usually 15–35 μ .... *Tilletia.*
2. Small to medium, usually 5–18 μ —
   (*a*) Sorus covered with a false membrane of fungoid cells... *Sphacelotheca.*
   (*b*) Protecting membrane, if any, of plant tissue.......... *Ustilago.*

B.—More or less firmly agglutinated at maturity—

1. Firmly agglutinated into irregular nodules .... *Melanopsichium.*
2. Developed around a central columella (rarely becoming dusty) *Cintractia.*

C.—Imbedded in leaves at maturity—

1. Usually hyaline or light colored.......................... *Entyloma.*

II. Spores in more or less regular balls :—

A.—Forming a dusty or granular sorus at maturity —

1. Spore balls consisting only of fertile cells—
   (*a*) Usually evanescent, olivaceous or black brown......... *Sorosporium.*
   (*b*) Quite permanent, spores adhering by folds of outer coat *Tolyposporium.*
2. Spore balls with outer sterile cortex....................... *Urocystis.*

B. Implanted in plant tissue at maturity —

1. Spore balls without definite cortex or sterile cells........... *Tuburcinia.*

Family I.— USTILAGINACEAE.

Ustilago (Pers.) Roussel[13], Fl. du Calvados ed. 2. 47. 1806.
Necrosis Paulet, Traite Champ. **1** : 584. 1793.
Ustilago Pers. Syn. Fung. 224. 1801. (sub-genus.).
Ustilagidium Heré. Zopf Beitr. Phys. Morph. Org. **5** : 7. 1895.

Sori on various parts of the hosts, at maturity forming dusty, usually dark colored spore masses; spores single, produced irregularly in the fertile mycelial threads which early entirely disappear through gelatinization; small to medium in size; germination by means of a septate promycelium producing only infection threads or with sporidia formed terminally and laterally near the septa; sporidia in water usually germinating into infection threads but in nutrient solutions multiplying indefinitely, yeast fashion.

Type: *Ustilago segetum* Pers., on Gramineae, France.

[13] Clinton, N. Am. Flora **71** : 3. 1906, points out that "J. Bauhin, Hist. Pl., 418, 1651, is really the founder of *Ustilago*. Fries or Persoon is ordinarily cited as authority for the genus. Fries used *Ustilago* as a genus in his Syst. Myc., **3** : 517. 1832, with *U. grandis* as the first species. Persoon used *Ustilago* as a subgenus under *Uredo* with *Uredo segetum* as the first species, having five varieties of which *U. Hordei* is first, and this may be taken as the actual type now that *U. segetum* has been broken up into several species. Roussel merely adopted *Ustilago* from Persoon, but raised it to full generic rank, giving three of Persoon's four species, of which *U. segetum* is one. Paulet's name, *Necrosis*, cannot be regarded as a true generic name, but was used more as a descriptive term."

* Spores smooth.

Ustilago Elionuri P. Henn. and Pole-Evans, Bot. Jahrb. (Engler) **41** : 270. 1908

Sori in the ovaries, 1-1.5 cm. long, covered with a dark-brown membrane of host tissue which dehisces apically revealing a semi-agglutinated brown spore mass; spores globose--ellipsoidal, irregular, somewhat angled, dark olive-brown, 5-7 μ diam., smooth under oil immersion.

Type host and locality: On *Elionurus argenteus* Nees, Pretoria, Transvaal, Union of South Africa.

On Andropogoneae: *Elionurus* (*Elyonurus*) *argenteus* Nees, Transvaal.[1] (M.H 102, 9316, 17268.)

Distribution: Transvaal and Argentina.

Ustilago Hordei (Pers.) Lagerh [2] Mitt. bad. bot. Ver. 70. 1889.

Reticularia segetum Bull. Hist. Champ. *pl.* 172, *fig. II.* 90. 1791.
Uredo segetum Hordei Pers. Tent. Disp. Fung. 57. 1797.
Uredo carbo DC. Fl. Fr. **6** : 76. 1815. p.p.
Ustilago segetum Link, Ditm. in Sturm's Deutsch. F.I III. **1** : 67. 1817. p.p.
Caeoma segetum Link, Willd. in Sp. Pl. **52** : 1. 1825. p.p.
Erysibe vera Hordei Wallr. Fl. Crypt. Germ. 2 : 217. 1833. p.p.
Uredo Carbo-Hordei Phillipar, Mem. Soc. Roy. Agr. Arts, Seine-et-Oise **37** : 195. 1837.
Ustilago Carbo vulgaris Hordeacea Tul., Ann. Sci. Nat. Bot. III. **7** : 80. 1847. p.p.
Ustilago segetum var. *Hordei* f. *tecta* Jens. Om Korns. Brand. **61** : 1888.
Ustilago tecta hordei Jens. Charb. Cereals 4. 1889.
Ustilago hordei Kell. and Sw. Ann. Rep. Kans. Agr. Exp. Sta. **2** : 268. 1890.
Ustilago Jensenii Rostr. Overs K. Danske Vid. Selsk. Forh. **1890** : 12. 1890.

Sori in the spikelets, destroying the inflorescence, forming a rather permanent purple-black spore mass covered by a permanent membrane, about 5-8 mm. long: Spores globose-subglobose, occasionally ellipsoidal, olivaceous-brown, 5–7 μ diam. or slightly larger, smooth.

Type host and locality: On *Hordeum vulgare* Linn., Europe.

On Hordeae: *Hordeum vulgare* Linn., Cape Colony, Transvaal, Orange Free State. (M.H. 1181, 7080, 9823.)

Distribution: Co-extensive with the cultivation of barley.

Ustilago levis (Kell. and Sw.) P. Magn. Abh. Bot. Ver. Prov. Brandenburg **37** : 69. 1896

Ustilago Avenae var. *levis* Kell. and Sw. Ann. Rep. Kansas Agr. Exp. Sta. **2** : 259. 1890.
Ustilago Kolleri Wille, Bot. Notiser **1893** : 10. 1893.

Sori in spikelets, more or less destroying basal and inner glumes; spores globose-subglobose, light olivecaous-brown, usually lighter colored on one side, 5–7 μ diam., sometimes slightly larger, smooth.

Type host and locality: On *Avena sativa* Linn., Kansas, United States.

On Aveneae: *Avena sativa* Linn., Cape Colony, Trnasvaal, Rhodesia.* (M.H. 538, 940, 7094, 8352, 10971.)

Distribution: Co-extensive with the cultivation of oats.

Ustilago affinis Ellis and Ev. Bull. Torrey Club **20** : 297. 1893.

Ustilago Hilariae P. Henn. Hedwigia **37** : 267. 1898. Not *Ustilago Hilariae* Ellis and Tracy, 1890.
Ustilago Stenotaphri P. Henn. Hedwigia **37** : 293. 1898. (Type from Windhoek, South West Africa, on *Stenotaphrum glabrum* = *Stenotaphrum secundatum* (Walt) Kuntze.) Not *U. Stenotaphri* McAlpine, 1895.

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[1] M.H. = Mycological Herbarium, Union Dept. Agric.

[2] Wakefield and Moore in Trans. Brit. Myc. Soc. **20** : 97, 1936, call attention to the fact that the authority for this smut species should be (Pers.) Lagerh. and not (Pers.) Kell. Swingle.

Ustilago americana Speg. Anal. Mus. Nac. Buenos Aires **6** : 201. 1899.
Ustilago Henningsii Sacc. and Sydow, Sacc. Syll. Fung. **16** : 368. 1902.

Sori in the spikelets, usually infecting every ovary in a spikelet, at first more or less hidden by the surrounding leaves, at first covered by a thin, delicate olive-brown membrane which ruptures revealing an olive-brown spore mass which soon disperses leaving a naked rachis; spores oblong-ovate, chiefly globose-subglobose, somewhat irregular, light reddish brown (almost hyaline), 5.5–8 μ diam., smooth.

Type host and locality: On *Stenotaphrum americanum* Schrank., Mandeville, Jamaica.

On Paniceae: *Stenotaphrum secundatum* (Walt.) Kuntze, South-West Africa. (M.H. 6879.)

Distribution: West Indies, South America, South Africa.

Ustilago Scitaminea H. Sydow,[3] Ann. Myc. **22** : 281. 1924.

Sori transforming the floral stem into a long, curved, leafless, stem-like growth covered by a thin membrane of host tissue, the lower part of the sori concealed by the sheath; spores globose-subglobose, reddish brown, 5–12 μ diam., smooth; groups of hyaline thin walled cells scattered through the sori.

Type locality and host: On *Saccharum officinarum* Linn., India, Java, Philippines.

On Andropogoneae: *Erianthus saccharoides* Michx., Natal; *Imperata arundinacea Cyrilli*, Natal; *Saccharum officinarum* Linn., Natal. (M.H. 11111.)

Ustilago puellaris Sydow, Ann. Myc. 33 : 231. 1935.

Sori entirely destroying the inflorescence, concealed by the glumes, cylindrical, usually 1 mm. long, occasionally 1–4 mm. long, covered by dark brown membrane which ruptures, disclosing a dark brown powdery spore mass; spores globose-subglobose, rarely ellipsoidal, regular, olivaceous brown with a narrow reddish brown epispore, 7–9 μ diam., smooth but sometimes indistinctly verruculate under the oil immersion.

Type host and locality: On *Hyparrhenia hirta* Stapf, Research Station, Nelspruit, Transvaal.

On Andropogoneae: *Hyparrhenia hirta* Stapf, Transvaal. (M.H. 26646.)

Distribution: Reported only from type locality.

Ustilago Crameri Korn. Jahrb. Nassau. Ver. Naturk. 27–28 : 11. 1875.

Sori in the ovaries, completely destroying them, ovoid, covered with a delicate membrane which when ruptured reveals a brownish, granular spore mass; spores globose-subglobose, reddish-brown, 7–10 μ diam., smooth even under oil immersion.

Type host and locality: On *Setaria italica* (Linn.) Beauv., Zurich, Switzerland.

On Paniceae: *Setaria italica* (Linn.) Beauv., Transvaal, Zululand*, Orange Free State. (M.H. 2204, 9817, 11716.)

Ustilago Cynodontis P. Henn.[4] Bot. Jahrb. (Engler) **14** : 369. 1891.

Sori destroying the inflorescence converting it into a mass of spores along the rachis, at first covered with a whitish-black membrane which breaks away revealing a black spore mass 2–4 cm. long, sometimes slightly longer; spores globose-subglobose, regular, reddish-brown, 7–10 μ diam., smooth or almost smooth but granular.

Type host and locality: On *Cynodon Dactylon* Pers., Abyssinia, Africa.

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[3] Sydow in 1924 (l.c.) pointed out that the smut on cultivated sugarcane was not *Ustilago Sacchari* Rab. and therefore proposed the name *Ustilago scitaminea* Syd. for the smut that attacks sugarcane.

[4] Verwoerd in Ann. Univ. Stellenbosch. A. **4** : 19. 1926, confuses *Ustilago Dregeana* Tul. and *U. Cynodontis* P. Henn. These are two very distinct species. *U. Dregeana* Tul. has papillate spores, 4–5 μ diam. (See Appendix A.), wihle *U. Cynodontis* P. Henn. has smooth spores, 7–10 μ diam.

On Hordeae: *Cynodon Dactylon* Pers., Orange Free State (M.H. 9752), Transvaal (M.H. 947, 112, 5636, 11005, 11014), Cape Province (M.H. 12953); *Cynodon incompletus* Nees, Transvaal (M.H. 1957, 8843), Orange Free State (M.H. 904), Cape Province (M.H. 25442).

Distribution: North America, Europe, Asia, Africa.

Ustilago Vaillanti Tul. Ann. Sci. Nat. III. **7**: 90. 1847.

Ustilago scillae Ciferri, Ann. Myc. **29**: 24. 1931.

Sori in pistils and anthers, perianth of diseased flowers persistent, somewhat enlarged and filled with spores, spores globose-ellipsoidal, sometimes angled, light reddish-brown, 7–11 μ diam., smooth but contents somewhat granular.

Type host and locality: On *Muscari comosum* (Linn.) Mill., Europe.

On Liliaceae: *Albuca altissima* Dryand., Cape Province (M.H. 15450); *Eucomis punctata* L'Herit., Cape Province (M.H. 2001); *Scilla Kraussii* Baker,[1] Inanda, Natal (M.H. 9525); *Scilla* sp., Cape Province,* Natal (M.H. 12956).

Distribution: United States, Europe, Africa.

Ustilago Dactyloctaenii P. Henn. Die Pflanzenwelt Ost-Afrika, Nachbar. C: 48. 1895.

Sori entirely destroying the inflorescence, at first covered by a membrane which flakes away revealing a dark purplish spore mass, at first slightly agglutinated but later powdery; spores globose-subglobose, regular, light olivaceous-brown, 7–14 μ diam., granular, smooth, epispore 1–2 μ.

Type host and locality: On *Dactyloctenium aegyptium* (L.) Richt. (=*Dactyloctenium aegyptiacum* Willd.), Zanzibar, Africa

On Chlorideae: *Dactyloctenium aegyptium* (L.) Richt., Cape Province (M.H. 9114); *Dactyloctenium geminatum* Hack., Portuguese East Africa (M.H. 14175).

** Spores not smooth.

Ustilago Avenae (Pers.) Jens. Charb. Cereales 4. 1889.

Reticularia segetum Bull. Champ. *pl.* 472, *fig. II.* 90. 1791. p.p.

Uredo carbo Avenae DC., Fl. Fr. 6. 76.

Ustilago segetum Link, Ditm. in Sturms Deutsch. Fl. III. **1**: 67. 1817. p.p.

Caeoma segetum Link, Willd. Sp. Pl. **62**: 1. 1825.

Erysibe vera Avenae Wallr. Fl. Crypt. Germ. 2: 217. 1833.

Uredo carbo-avenae Phillipar, Mem. Soc. Roy. Agr. Arts Seine-et-Oise **37**: 194. 1837.

Ustilago carbo-vulgaris avenae Tul. Ann. Sci. Nat. Bot. III. **7**: 80. 1847.

Ustilago segetum Avenae Jens. Om Korns. Brand 61. 1888.

Ustilago Avenae f. *foliicola* Almeida, Revista Agron. (Lisbon), **1**: 20. 1903.

Sori in the spikelets, 5–12 mm. long, usually destroying the inflorescence rather completely and most of the spores finally being blown away, rarely on the leaves or culms; spores spherical to subspherical or sometimes more elongate, olivaceous-brown, sometimes lighter colored on one side of the spore, 5–7 μ diam., minutely echinulate.

Type host and locality: On *Avena sativa* Linn., Europe.

On Avenae: *Avena sativa* Linn., Cape Province, Transvaal. (M.H. 8923.)

Distribution: Co-extensive with cultivated oats.

Ustilago Holubii Sydow, Ann. Myc. **33**: 230. 1935.

Sori entirely destroying the panicle and sometimes extending into the end of the culms usually 2–4 cm. long, covered by a dark colored membrane which flakes away revealing a brown spore mass; spores globose-subglobose, olivaceous-brown, 5–7 μ diam., apparently smooth but minutely verruculate under oil immersion.

Type host and locality: On *Echinochloa Holubii* Stapf, Pretoria, Transvaal, Union of South Africa.

On Panicaceae: *Echinochloa* (*Panicum*) *Holubii* Stapf, Cape Province,* British Bechuanaland, Transvaal.* (M.H. 24942 (type), 17042.)

Distribution: South Africa.

Ustilago Tritici (Pers.) Rostrup, Overs. Danske. Vid. Selsk. Forh. **1890**: 15. Mr. 1890.
Lycoperdon Tritici Bjerk. Kgl. Schmedisch Akad. Wiss. Abhandl. **37**: 326. 1775.
Uredo segetum Tritici Pers. Disp. Meth. Fung. 57. 1797.
Uredo carbo Tritici DC. Fl. Fr. **6**: 76. 1815.
Ustilago setum Ditm. Sturm's Deuts. Flore III. **1**: 67. 1817.
Caeoma segetum Link, Willd. Sp. Pl. **62**: 1. 1825.
Erysibe vera Tritici Wallroth, Fl. Crypt. Germ. **2**: 217. 1833.
Uredo Carbo-Tritici Philippar, Soc. Roy. Agr. Arts Seine-et-Oise **37**: 197. 1837.
Ustilago Carbo vulgaris Triticea Tul. Ann. Sci. Nat. Bot. III. **7**: 80. 1847.
Ustilago segetum var. *Tritici* Jens. Om Korns. Brand 61. 1888.
Ustilago Hordei Bref. Nach. Klub. Landw. Berl. No. 1593. 1888.
Ustilago Tritici Jens. Kelleran and Swingle in Ann. Rep. Kansas Exp. Sta. **2**: 262. 1890.
Ustilago Tritici foliicola P. Henn. Zeitschr. Pflanzen. **4**: 139. 1894.
Ustilagidium Tritici Herzb. Zopff. Beitr. Phys. Morph. Neiderer Org. **5**: 7. 1895.
Ustilago Vavilovi Jacz. (Ann. State Inst. Exp. Agr. III. 2 1: 105 109. 1925. Transl. Title).

Sori in the spikelets, forming a dusty olive-brown spore mass, eventually destroying all of the inflorescence and the spores are blown away leaving only the naked rachis; spores spherical or subspherical, sometimes more elongated and irregular, light olive-brown, usually lighter colored on one side of the spore, 5 9 μ diam., minutely but distinctly echinulate. While the entire wheat spike is usually destroyed and only the naked rachis left, yet partial destruction of the spike is not uncommon. Under rare conditions the sorus develops on the sheaths and leaves.

Type host and locality: On *Triticum vulgare* Vill., Europe.

On Hordeae: *Triticum vulgare*, Cape Colony*, Orange Free State, Transvaal. (M.H. 1068, 9821.)

Distribution: Co-extensive with the cultivation of wheat.

Ustilago Fingerhuthiae Sydow, Ann. Myc. **33**: 230. 1935.

Sori in the ovaries, 2–5 mm. long, scattered throughout the spike, covered with a yellowish membrane that dehisces revealing a brownish, granular, spore mass; spores globose-subglobose, regular, olivaceous-brown 5-10 μ diam., densely but minutely verruculose-echinulate.

Type host and locality: On *Fingerhuthia africana* Lehm., Pretoria, Transvaal, Union of South Africa.

On Festuceae: *Fingerhuthia africana* Lehm., Transvaal. (M.H. 1085, 7405, 8909.)

Distribution: Not reported except from type locality.

Ustilago trichophora (Link) Kunze, Flora **1**: 369. 1830.
Caeoma trichophora Link, Willd. Sp. Pl. **62**: 3. 1825.
Uredo trichophora Körn. Hedwigia **16**: 36. 1877.

Sori as small nodules in the individual ovaries, scattered in the panicle, singly or in groups, 2–5 mm. long, covered by a yellowish tough, hispid membrane, spore mass at first hard, agglutinated but later powdery; spores globose-subglobose, light reddish-brown (some immature spores almost hyaline), 7–8 μ diam., abundantly echinulate under oil immersion.

Type host and locality: On *Echinochloa colona* (*Panicum colonum* Linn.), Egypt.
On Paniceae: *Echinochloa Crus-galli* Beauv. (*Panicum Crus-galli* Linn.), Cape Province. (M.H. 9424.)
Distribution: Africa.

Ustilago Trachypogonis Zundel n. sp.

Sori in the ovaries, protected by the outer glumes, about 1 cm. long, spore mass granular, dark brown; spores globose-subglobose, occasionally ellipsoidal, brown with a distinctly reddish-brown epispore, 7–9 μ diam., echinulate.

Hab. in the ovaries of *Trachypogon plumosus* Nees., Kaalfontein, Transvaal, Union of South Africa, Coll A.O.D. Mogg, Feb. 22, 1918. (M.H. 11709.)

Latin description:

Soris in ovariis, glumis externis tectis, ca. 1 cm. longis, globis sporarum grandularibus, atro-brunneis; sporis globosis v. sub-globosis, interdum ellipsoideis, brunneis, 7–9 μ diam., echinulatis; episporio conspicue rubro-brunneo.

Hab. in ovariis *Trachypogonis plumosi* Nees., Kaalfontein, Transvaal, Unione Africae Australis, Coll. A. O. D. Mogg, Feb. 22, 1918. (M.H. 11709.)

Ustilago Schlechteri P. Henn. Hedwigia **34**: 325. 1895.

Sori in the panicles, 8 or more cm. long, deforming and destroying the inflorescence, at first covered with a membrane which ruptures revealing a dark spore mass; spores globose-subglobose or sometimes ellipsoidal, deep olivaceous-brown with a deeper almost reddish-brown epispore, 7–10 μ diam., or sometimes slightly larger, minutely echinulate-verruculose under oil immersion.

Type host and locality: On *Sporobolus* sp., Tweedie, Natal. (M.H. 11644.)
On Agrostideae: *Sporobolus* sp., Natal. (M.H. 11644.)
Distribution: Union of South Africa.

Ustilago Crus-galli Tracy and Earle, Bull. Torrey Club **22**: 175. 1895.

Sori surrounding the stem at nodes or place of inflorescence, attacking both stem and leaves, nodular, elongated, swollen, several cm. long, surrounded by a tough hispid membrane, spore mass brown, powdery; spores ovoid to spherical, occasionally more elongate, olivaceous-brown, 7–10 μ diam., bluntly echinulate.

Type host and locality: On *Panicum crus-galli* Linn., Salt Lake City, Utah, United States.
On Paniceae: *Echinochloa Holubii* Stapf, Transvaal. (M.H. 2247.)
Distribution: United States, Europe, Asia, Africa, Australia.

Ustilago Zeae (Beckm.) Unger. Einfl. Bodens 211. 1836.
Lycoperdon zeae Beckm. Hannov. Mag. **6**: 1330. 1768.
Uredo segetum Mays Zeae DC. Fl. Fr. **2**: 596. 1805.
Uredo Zeae Mays DC., Lamarck Enc. Meth. Bot. **8**: 229. 1808.
Uredo maydis DC. Fl. Fr. **6**: 77. 1915.
Uredo Zeae Schw. Fung. Car. No. 71. 1815.
Caeoma Zeae Link, Willd. Sp. Pl. **62**: 2. 1825.
Erysibe Maydis Wallroth, Fl. Crypt. Germ. **2**: 215–16. 1833.
Ustilago Maydis Corda, Corda Icon. Fung. **5**: 3. 1842.
Ustilago Schweinitzii Tul. Ann. Sci. Nat. Bot. III. **7**: 86. 1847.
Ustilago Zeae-Mays Wint. Rab. Krypt.-Fl. **11** - 97. 1881.
Ustilago Euchlaenae Arcang. Erb. Critt. Ital. **11**: 1132. 1882.
Ustilago Mays zeae Magnus, Deuts. Bot. Monatschr. **13**: 50. 1895.

Sori forming on any part of the host above ground as irregular pustules measuring a few mm. to large boils several dm. in diam., at first covered with a membrane composed of host tissue intermixed with fungous threads which later breaks revealing an olive-brown spore mass; spores globose to subglobose or sometimes ellipsoidal, regular, reddish-brown, 7-10 μ diam., bluntly echinulate.

Type host and locality: On *Zea Mays* Linn., Europe.

On Andropogoneae: *Zea Mays* Linn., Cape Colony (M.H. 1178, 14699, 11632), Natal,* Transvaal.*

Distribution: North America, Europe, Asia, Africa, Philippine Islands.

Ustilago bromivora (Tul.) Fisch. de Waldh. Bull. Soc. Nat. Moscow **40**[1] : 252. 1867.

Ustilago carbo vulgaris bromivora Tul. Ann. Sci. Nat. Bot III. **7** . 81. 1847.

Cintractia patagonica Cooke and Massee, Grevillea **18** . 34. 1899.

Ustilago Brachypodii Maire, Bull. Soc. Hist. Nat. Afr. Nord **9** : 46. 1918.

Ustilago Brachypodii-distachyi Maire, Bull. Soc. Hist Nat. Afr. Nord **10** : 46 1919.

Ustilago bromivora Tul. forma *Brachypodii* Hariot, Bull. Soc. Hist. Nat Afr Nord **12** : 192– 1921.

Ustilago bromi-arvensis Liro, Ann. Acad. Sci. Fenn. A. **17** : 93. 1924.

Ustilago Bromi-mollis Liro, Ann. Acad. Sci. Fenn. A. **17** · 94. 1924.

Sori in the spikelets, usually confined within the glumes, sometimes infecting base of glumes, covered with a delicate white membrane, usually bullate, agglutinated then powdery; spores globose-subglobose, occasionally broadly ellipsoidal, dark reddish-brown to olivaceous-brown, chiefly 7-11 μ diam., abundantly verruculose.

Type host and locality: On *Bromus secalinus* Linn., Europe.

On Festuceae: *Bromus unioloides* H.B.K., Cape Colony (M.H. 541, 1248, 11001, 12832), Orange Free State (M.H. 2091), Transvaal (M.H. 280, 281, 285, 195, 129, 6933).

Distribution: North America, Europe, Asia, Africa, Australia, New Zealand.

Ustilago Andropogonis-finitimi Maub. Bull. Soc. Myc. (France) **22** : 74 75. 1906.

Sori in the ovaries, long linear, 5 7 mm. long, covered with a membrane of host tissue; spore mass brown, agglutinated, surrounding a well developed columella; spores globose-subglobose, semi-opaque, dark reddish-brown, 9 12 μ diam., abundantly echinulate unde- oil immersion.

Type host and locality: On *Andropogon finitimus* Hochst. Portuguese East Africa

On Andropogoneae: *Andropogon finitimus* Hochst., Portuguese East Africa.

Distribution: Reported only from type locality.

Ustilago Rabenhorstiana Kuhn, Hedwigia **15** : 4. 1876.

Caeoma Syntherismae Schw. Trans. Am. Phil. Soc. II. **4** : 290. 1834.

Ustilago Setariae Rabenh. Univ. itin. Krypt. No. 1866. Year*

Ustilago destruens var. *Digitariae* Sacc. Nuo. Giorn. Bot. Ital. **8** : 167. 1876.

Ustilago Cesati Fisch. de Waldh. Apercu **25** · 1877. p.p.

Ustilago Syntherismae Auct. p.p. Cke. Grevillea **6** : 138. 1878.

Sori usually destroying the entire inflorescence, linear oblong, 3-5 cm. long, at first concealed by the enveloping glumes but finally becoming visible as a black-brown dusty spore mass surrounding the elongate remnants of the inflorescence; spores globose sub-globose, occasionally somewhat angled, olivaceous-brown, 10-13 μ diam., verruculose.

Type host and locality: On *Panicum sanguinale* Linn., Europe.

On Paniceae: *Digitaria ternata* Stapf, Natal (M.H. 11703); *Digitaria* sp., Rhodesia (M.H. 13999), Transvaal (M.H. 11704).

[1] This species is similar to, if not identical with *Ustilago sphaerogena* Burrill, found in North America.

Ustilago Peglerae Sydow and Bubak, Ann. Myc. **12**: 264. 1914.

Sori destroying the anthers, olivaceous-black; spores ellipsoidal to oblong, seldom globose to subglobose, frequently irregular, olivaceous-brown, 10–14 μ long, verruculose.

Type host and locality: On *Ornithogalum lacteum* Jacq., Cape Province, Union of South Africa.

On Liliaceae: *Ornithogalum lacteum* Jacq., Cape Colony (M.H. 7101).

Distribution: Cape Province.

Ustilago Evansii P. Henn. Bot. Jahrb. (Engler) **41**: 270. 1908.

Sori destroying all ovaries on the spike, 2–3 mm. long, covered with an olivaceous membrane; spore mass granular, olive-brown; spores globose subglobose, regular, olivaceous-brown, light colored almost hyaline, spores abundant throughout the sorus, various sizes, 14–21 μ diam., abundantly and coarsely echinulate, bifurcate conidiophores abundant.

Type host and locality: On *Setaria sphacelata* Stapf and Hubb. (=*Setaria aurea* A. Br.), Zoutpansberg, Transvaal, Union of South Africa.

On Paniceae: *Setaria sphacelata* Stapf. and Hubb., Natal (M.H. 7757), Transvaal (M.H. 7797), Rhodesia (M.H. 14003), Zululand (M.H. 15441, 17041, 17045); *Setaria nigrirostris* Dur. and Schinz., Transvaal, Rhodesia; *Setaria* sp., Southern Rhodesia.

Farysia Raciborski, Sci. Cl. Sci. Math. Nat. 1. **1909**: 354. 1909.

Elateromyces Bubak, Houby Céská Dil. II. **1912**: 32. 1912.

Sori in various parts of the host, at maturity forming dusty, usually dark spore masses, intermixed with parallel, elater-like strands of host tissue and sterile hyphae; spores single, produced in chains as in *Ustilago* but intermixed with sterile hyphae and strands of host tissue which function as elaters.

Farysia olivacea DC. H. and P. Sydow, Ann. Myc. **17**: 41. 1919.

Uredo olivacea DC. Fl. Fr. **6**: 78. 1815.

Caeoma olivaceum Schlecht. Fl. Berol. **2**: 130. 1824.

Erysibe olivacea Wallr. Fl. Crypt. Germ. **2**: 215. 1833.

Ustilago olivacea Tul. Ann. Sci. Nat. III. **7**: 88. 1847.

Ustilago catenata Ludw. Zeits. Pflanz. **3**: 139. 1893.

Cintractia caricicola P. Henn. Hedwigia **34**: 325. 1895.

Ustilago caricicola Tracy and Earle, Bull. Torrey Club **26**: 493. 1899.

Ustilago subolivacea P. Henn. Ann. R. Istit. Bot. Roma **6**: 84. 1897.

Elateromyces olivacea Bubak, Houby Cesky Dil. II. **1912**: 32. 1912.

Farysia americana Ciferri, Ann. Myc. **29**: 73. 1931.

Sori in occasional ovaries, often at first partly concealed by the perigynium, ovate, 2–6 mm. in diam., at first with agglutinated spores which later become powdery, with conspicuous elaterlike threads intermixed with the spores; spores olivaceous-brown, irregular, varying from globose to oblong or linear but sometimes more regular and then chiefly 7–9 μ diam., the most elongate about 12 μ long and about 4 μ wide, abundantly but minutely verruculate.

Type host and locality: On *Carex riparia* Curtis, France.

On Cyperaceae: *Carex ethiopica* Schkuhr., Cape Province; *Carex phacota* Spreng., Cape Province. (M.H. 8812.)

Distribution: North America, South America, West Indies, Europe, Asia, South Africa, New Zealand, Tasmania, Australia.

Sphacelotheca De Bary, Verg. Morph. Biol. Pilée 187. 1884.

Sporisorium Ehrenb. Link Willd. Sp. Pl. **62**: 86. 1825.

Endothlaspis Sorokin, Rev. Myc. **12**: 4. 1890.

Sori usually in the inflorescence, often limited to the ovaries, provided with a definite (more or less) temporary false membrane covering a dusty spore mass and a central columella of plant tissue; false membrane composed largely or entirely of definite sterile fungous cells which are hyaline or slightly tinted; oblong to spherical, and usually more or less firmly bound together; spores simple, usually reddish-brown, developed in a somewhat centripital manner as in *Cintractia*, small to medium in size; germination as in *Ustilago*.

Type: *Uredo Hydropiperis* Schum., on *Polygonum Hydropiper* Linn., Europe.

Sphacelotheca Anthephorae (Syd.) Zundel n.n.

Ustilago Anthephorae Syd. Ann. Myc. **12**: 197. 1914.

Sori completely destroying the inflorescence hidden by the glumes, about 1 cm. long, surrounded by a delicate membrane which dehisces apically revealing an agglutinated brown spore mass surrounding a well formed columella and breaking up into sterile cells; sterile cells subglobose-irregular, hyaline, singly or in chains, about 7 μ diam.; spores globose-subglobose, reddish-brown, 3.5-4.5 μ diam., smooth.

Type host and locality: On *Anthephora pubescens* Nees, Grootfontein, South West Africa.

On Zoysieae: *Anthephora pubescens* Nees, South West Africa.* Transvaal (M.H. 2219, 5151), Orange Free State (M.H. 26644).

Distribution: Southern Africa.

* Spores smooth.

Sphacelotheca Sorghi (Link) G. P. Clinton, Jour. Myc. **8**: 140. 1902.

Sporisorium Sorghi Link, Willd. Sp. Pl. **62**: 86. 1825.

Tilletia Sorghi-vulgaris Tul. Ann. Sci. Nat. III. **7**: 116. 1847.

Ustilago sorghi Pass. Thum. Hedwigia **12**: 114. 1873.

Cintractia Sorghi-vulgaris G. P. Clinton, Bull. Ill. Agr. Exp. Sta. **47**: 401. 1897.

Sori destroying the ovaries which are elongated about twice the normal length of the seed, covered with an evident false membrane which ruptures revealing a brown spore mass surrounding a short, thick, well developed columella; false emmbrane usually breaking up into chains of small hyaline sterile cells, subglobose-ellipsoidal, 3 10 μ diam.: spores globose subglobose, reddish-brown, 3-8 μ diam., mostly about 5 μ diam., smooth.

Type host and locality: On *Sorghum vulgare* Pers., Egypt.

On Andropogoneae: *Sorghum vulgare* Pers. v. *caffrorum* (Thun.) Hubb. et Rehder (=S. *caffrorum* Beauv. and =*Andropogon sorghum* Brot. var.), Cape Province, Natal (M.H. 17271), Transvaal (M.H. 315, 316, 5635, 2088, 7786).

Distribution: Co-extensive with cultivated sorghums.

Sphacelotheca Moggii Zundel, Mycologia **22**: 130. 1930.

Sori in the inflorescence, long linear, 5–10 mm. long, at first usually hidden by the outer leaf sheath, later protruding, covered with a false tissue which flakes away revealing a dark brown, agglutinated spore mass surrounding a well developed, often forked, columella; sterile tissue very fragile and "tissue like," somewhat effervescent, adhering more or less to the sori and breaking up into groups or balls of sterile cells which are tinted brown, vacuolated and granular, 7–12 μ diam., sterile-cell balls containing 4 or more cells, globose-subglobose, 15–22 μ diam.; balls of sterile cells are scattered throughout the sori; spores globose–subglobose, regular, tinted olivaceous-brown to almost hyaline, vacuolated, 4–6 μ diam., under oil immersion, smooth.

Type host and locality: On *Cymbopogon plurinodis* Stapf, Armoedsvlakte, British Bechuanaland.

On Andropogoneae: *Cymbopogon plurinodis* Stapf, British Bechuanaland. (M.H. 19859:)

Distribution: Not reported except from type locality.

Sphacelotheca cruenta (Kuhn) Potter, Phytopath. **2**: 98. 1912.

Ustilago cruenta Kühn, Hamburg Gart. Blumenztig. **28**: 177–178. 1872.

Ustilago Tulasnei Kühn, Rab. Fungi Eur. No. 1997. 1875.

Sphacelotheca cruenta Bubak, Archiv Pirod. Vyck. Cech. **15**: 27. 1912. Archiv. Naturw. Landes. Bohmen **15**: 26. 1916.

Sori destroying the ovaries, which are scarcely larger than normal, covered by an evident membrane which flakes away into globose sterile cells revealing a brown granular spore mass surrounding a long, curved, well developed columella; groups of large globose sterile cells scattered throughout the sori; sterile cells hyaline, globose–subglobose, singly or in groups, 9–14 μ diam.; spores globose–subglobose, light reddish-brown, 5–8 μ diam., smooth.

Type host and locality: *Sorghum vulgare* Pers., Halle, Germany.

On Andropogoneae: *Sorghum halepense* Pers., Tanganyika Territory; *Sorghum vulgare* Pers., Tanganyika Territory; *Sorghum* sp., Tanganyika Territory.

Distribution: North America, Europe, West Indies, Africa.

Sphacelotheca Vryburgii Zundel, Mycologia **23**: 298. 1931.

Sori in the inflorescence, long linear, 5–10 mm. long, at first hidden by the glumes but later protruding, covered by a reddish-brown, delicate false membrane which flakes away revealing an agglutinated black spore mass surrounding a well developed much branched columella; sterile cells hyaline, globose, usually in groups, 9–15 μ diam.; spores globose–subglobose, occasionally angled, very light reddish-brown, 4–8 μ diam., smooth, contents finely granular with a hyaline to light coloured wall under oil immersion.

Type host and locality: On *Themeda triandra* Forsk. (=*Themeda Forskalii* Hack.), Vryburg, British Bechuanaland.

On *Themeda triandra* Forsk., British Bechuanaland (M.H. 9733.)

Distribution: Reported only from type locality.

Sphacelotheca concentrica Zundel, Mycologia **22**: 138. 1930.

Sori in the inflorescence, broadly elongate, 1 cm. or less in length, at first concealed by the glumes, covered by an evident light coloured false membrane which flakes away revealing a partially agglutinated dark spore mass surrounding a well formed columella; sterile tissue breaking up into hyaline cells, globose, somewhat variable in size, ranging from 10–21 μ diam.; spores globose subglobose, under oil immersion the spore is divided into four concentric parts, an outer dark brown area, then a light reddish-brown area and an inner vacuolated, light coloured area, surrounded by a second dark brown area, 6–8 μ diam. but sometimes 4–8 μ diam., smooth.

Type host and locality: On *Cymbopogon plurinodis* Stapf, Pretoria, Union of South Africa.

On Andropogoneae: *Cymbopogon plurinodis* Stapf, Transvaal (M.H. 10708).

Distribution: Not reported except from type locality.

Sphacelotheca densa (McAlp.) Ciferri, Ann. Myc. **26**: 32. 1928.

Cintractia densa McAlp., Smuts of Australia 168. 1910.

Sori destroying the inflorescence and forming a long rachis, covered with a greyish membrane which flakes away exposing a dark spore mass; spores globose–subglobose, light olivaceous-brown, 6–7 μ diam., smooth.

Type locality and host: On *Rottboellia compressa* Linn., Burnley near Melbourne, Victoria, Australia.

On Andropogoneae: *Rottboellia compressa* Linn., Natal (M.H. 12957).

Distribution: Australia, South Africa.

Sphacelotheca Doidgeae Zundel, Mycologia **22**: 131. 1930.

Sori in the inflorescence usually involving the entire spikelet along the rachis, long linear, frequently irregularly branched or compound, 3–8 mm. long, covered with an evident,

thick, brown, false membrane, which dehisces from the apex disclosing a brown, agglutinated mass of spores surrounding a well developed irregular columella ; sterile tissue breaking up into groups or chains of hyaline sterile cells, 6–10 μ diam. ; groups of large globose sterile cells through the sori ; spores globose–subglobose, thick walled, olivaceous brown, 6–10 μ diam., under oil immersion, smooth and finely granular.

Type host and locality : On *Bothriochloa glabra* A. Camus, Edendale, Natal, Union of South Africa (M.H. 1997).

On Andropogoneae : *Bothriochloa* sp. Transvaal (M.H. 15058) ; *Andropogon intermedius* R. Br., Natal (M.H. 8939) ; *Bothriochloa glabra* A. Camus, Natal (M.H. 1997).

Distribution : Southern Africa.

Sphacelotheca tenuis (H. and P. Sydow) Zundel, Mycologia **22** : 137. 1930.

Ustilago tenuis H. and P. Sydow, Ann. Myc. **4** : 425. 1906.

Sori destroying the inflorescence, ½–1 cm. long, covered with a more or less permanent false membrane which flakes away revealing a semi-powdery spore mass surrounding a well developed columella ; cells of sterile membrane are inclined to fuse and largely lose their cellular structure, appearing as a more or less amorphous mass, however, some globose cells retain their identity ; spores globose–subglobose, somewhat irregular and angular, thick walled, olivaceous-brown, 6–10 μ diam., smooth and finely granular under oil immersion.

Type host and locality : On *Bothriochloa pertusa* A. Camus (*Andropogon pertusus* Willd.), Hunsur, Mysore, India.

On Andropogoneae : *Hyparrhenia* sp., Natal (M.H. 11862).

Distribution : India, South Africa.

Sphacelotheca columellifera (Tul.) Ciferri, Ann. Myc. **26** : 32. 1928.

Ustilago carbo var. *columellifera* Tul. Ann. Sci. Nat. Bot. III. **7** : 81. 1847.

Cintractia columellifera (Tul.) McAlpine, Smuts of Austr., 166. 1910.

Sori destroying the inflorescence, long linear, 5 7 cm. long, at first concealed by the sheath but later protruding, covered by an evident yellowish-white, false membrane which flakes away revealing a dark brown agglutinated spore mass surrounding a well developed, hollow columella ; false membrane disintegrating into groups or chains of globose, hyaline sterile cells, 7–12 μ diam. ; spores generally globose, regular but occasionally subglobose, light reddish-brown, usually 7 μ diam., but occasionally 9 μ, under oil immersion, smooth with vacuolated contents.

Type host and locality : *Andropogon australis* Spreng., Queensland, Australia.

On Andropogoneae : *Heteropogon contortus* R. and S. (= *Heteropogon hirtus* Pers.), Tanganyika Territory.

Distribution : Australia, Africa.

Sphacelotheca Ruprechtii Sydow, Ann. Myc. **33** : 232. 1935.

Sori entirely destroying the inflorescence, cylindrical, 4–8 mm. long, at first concealed by the glumes but later protruding, covered by a leathery, olivaceous false membrane which ruptures disclosing a dark agglutinated spore mass surrounding a well developed simple or bifurcate columella ; sterile cells globose- subglobose, hyaline, in pairs or in groups, rarely in chains, 10–14 μ diam., spores globose-subglobose, regular, olivaceous-brown 7–10 μ diam., smooth but granular under the oil immersion lens.

Type host and locality : On *Hyparrhenia Ruprechtii* Fourn. (*Andropogon Ruprechtii* Hack.), Marikana, Rustenburg, Transvaal, Union of South Africa.

On Andropogoneae : *Hyparrhenia Ruprechtii* Fourn., Transvaal (M.H. 27377).

Distribution : Southern Africa.

Sphacelotheca Evansii Zundel, Mycologia **22** : 133. 1930.

Sori in the inflorescence, hidden by the glumes, inconspicuous, 5–10 mm. long, covered by an evident membrane which flakes away revealing a dark brown spore mass surrounding

a well developed columella ; false tissue rather permanent, breaking up into large groups or chains of sterile cells ; groups of sterile cells through the sorus ; sterile cells hyaline, irregular, globoid, 9–12 μ diam. ; spores globose-subglobose, regular, olivaceous-brown, 8–10 μ diam., under oil immersion, smooth and vacuolated.

Type host and locality : On *Hyparrhenia Ruprechtii* Fourn., Olifants River, Transvaal, Union of South Africa.

On Andropogoneae : *Hyparrhenia Ruprechtii* Fourn., Transvaal (M.H. 14174).

Distribution : Transvaal.

Sphacelotheca Andropogonis (Opiz) Bubak, Naturw. Landes. Böhmen, **15** : 25. 1916.

Ustilago Ischaemi Fuckel, Enum. Fung. Nass. 22 : 1861.

Ustilago cylindrica Peck, Bot. Gaz. **7** : 55. 1882.

Cintractia Ischaemi Syd. Oesterr. Bot. Zeitsch. **51** : 12. 1901.

Sphacelotheca Ischaemi Clint. Jour. Myc. **8** : 140. 1902.

Sori usually involving entire inflorescence, hidden by the sheath, long linear, 10 40 mm. long by 1 4 mm. wide, covered by a false membrane which flakes away disclosing a brown spore mass surrounding a well developed columella ; false membrane rather permanent, breaking up into large masses of tissue rather than individual sterile cells, sterile cells through the sori ; sterile cells globose–subglobose, flattened when in contact with each other, hyaline or when en masse, tinted brown, 7–16 μ diam. ; spores globose –subglobose medium reddish-brown, minutely granular, 8–10 μ diam. smooth.

Type host and locality : On *Andropogon Ischaemum* Linn., Prag, Czechoslovakia.

On Andropogoneae : *Bothriochloa glabra* A. Camus. Natal (M.H. 1080, 7759), Transvaal (M.H. 1073, 1921) ; *Cymbopogon Schoenanthus* Spreng., Transvaal (M.H. 1921) ; *Hyparrhenia Ruprechtii* Fourn., Transvaal (M.H. 1156, 10096).

Distribution : North America, Europe, Asia, Africa, Philippine Islands.

Sphacelotheca Dinteri (H. and P. Sydow) Zundel, Mycologia **22** : 140. 1930.

Ustilago Dinteri H. and P. Sydow, Ann. Myc. **13** : 37. 1915.

Sori destroying the entire enflorescence, almost entirely hidden by the terminal sheath, long linear, 2–4 cm. long, covered by an evident brown false membrane which flakes away revealing a semi-powdery, brown, spore mass surrounding a well formed columella ; sterile cells globose–subglobose or sometimes ellipsoidal, individually or in groups, tinted brown, 7–12 μ diam. ; spores globose-subglobose or occasionally ellipsoidal, frequently angular, thick walled, finely granular, olivaceous brown, 9–12 μ diam., smooth.

Type host and locality : On *Dicanthium papillosum* Stapf (=*Andropogon papillosus* Hochst.), Pijikuara-Okaharni, South West Africa.

On Andropogoneae : *Dichanthium papillosum* Stapf, South West Africa.

Distribution : South West Africa.

Sphacelotheca natalensis Zundel, Mycologia **22** : 139. 1930.

Sori in the inflorescence, long linear, 3–6 mm. long, covered by an evident brown false membrane which flakes away revealing an agglutinated spore mass surrounding a well developed, simple, columella ; sterile cells globose, usually hyaline, mostly in groups or short chains, reddish-brown en masse, variable in size, 12–15 μ diam. ; spores globose–subglobose, thin walled, light reddish-brown, 10–12 μ diam., smooth even under oil immersion.

Type host and locality : On *Cymbopogon excavatus* Stapf, Mooi River, Natal, Union of South Africa.

On Andropogoneae : *Cymbopogon excavatus* Stapf, Natal (M.H. 11705).

Distribution : Not reported except from type locality.

Sphacelotheca transvaalensis Zundel, Mycologia **22** : 139. 1930.

Sori destroying the inflorescence, broadly linear, 5–10 mm. long, covered by a thick, dark brown, false membrane which flakes away revealing a black spore mass surrounding

a large, well developed, branched, root-like, central columella and numerous surrounding smaller columellae. (Resembling a small root system of an herbaceous plant); sterile cells globose–subglobose, hyaline, delicate, large, single or in short chains, 11–12 μ diam.; spores globose–subglobose, regular, reddish-brown, 10–12 μ diam., smooth but finely granular under oil immersion.

Type host and locality: On *Sorghum versicolor* Anderss., Onderstepoort, Pretoria, Transvaal, Union of South Africa.

On Andropogoneae: *Sorghum versicolor* Anderss. Transvaal (M.H. 17047).

Distribution: South Africa.

** Spores not smooth.

Sphacelotheca Milbraedii (H. and P. Sydow) Zundel, Mycologia **22**: 135. 1930.

Ustilago Milbraedii H. and P. Sydow, Wissensch. Ergebn. Deutsch Zentral. Exped. 1907 1908: 95. 1911.

Sori in the ovaries, long linear, 3–5 cm. long, covered with an evident false membrane which flakes away disclosing a semi-powdery spore mass surrounding a well formed columella, outer false membrane rather persistent, breaking up into large groups of sterile cells, rectangular, tinted brown, groups of sterile cells through the sori, subglobose, tinted brown, 9–12 μ diam.; spores globose subglobose, irregular, somewhat angular, thin walled, light brown with a darker coloured centre, 3 8 μ diam., under oil immersion faintly echinulate.

Type host and locality: On *Cymbopogon Schoenanthus* Spreng. (*Andropogon Schoenanthus* Linn.), Mpororo, Tanganyika Territory.

On Andropogoneae: *Cymbopogon Schoenanthus* Spreng., Tanganyika Territory.

Distribution: Tanganyika Territory.

Sphacelotheca Amphilophis Sydow, Ann. Myc. **33**: 232. 1935.

Sori destroying the entire inflorescence, 1–2 cm. long, at first covered by a false membrane which flakes away revealing a dark brown agglutinated spore mass surrounding a large, well developed, simple or bitrifurcate columella; sterile cells scattered throughout the sori, usually in rather agglutinated groups but occasionally single or in groups of two or three, hyaline, globose–subglobose, regular, 7–13 μ diam.; spores globose-subglobose, rarely ellipsoidal, regular, olivaceous brown, 5–7 μ diam., apparently smooth but under the oil immersion lens sometimes indistinctly verruculose.

Type host and locality: On *Bothriochloa insculpta* A. Camus (= *Amphilophis insculpta* Stapf), along Crocodile River at Schagen, Barberton, Transvaal.

On Andropogoneae: *Bothriochloa insculpta* A. Camus, Transvaal (M.H. 26023).

Distribution: Reported only from type locality.

Sphacelotheca Ritchiei Zundel, Mycologia **22**: 138. 1930.

Sori in the inflorescence, long linear, 5 8 mm. long, sometimes gregarious, at first concealed by the glumes, later protruding, covered by an evident dark brown false membrane which flakes away apically, revealing a brown spore mass surrounding a well developed columella; sterile cells hyaline, in pairs, in short chains or in groups (usually in pairs) usually larger than the spores, 9–12 μ diam., sometimes up to 15 μ, thin walled and somewhat fragile; spores globose–subglobose, regular, reddish-brown, 6 10 μ diam., under oil immersion minutely verruculate.

Type host and locality: On *Hyparrhenia cymbaria* Stapf, Morogoro, Tanganyika Territory.

On Andropogoneae: *Hyparrhenia cymbaria* Stapf, Tanganyika Territory (M.H. 20650).

Distribution: Not reported except from type locality.

Sphacelotheca Holci H. S. Jackson, Monogr. Univ. Puerto Rico, Ser. B., No. 2: 259. 1934.

Sori in the ovaries, concealed by and not exceeding the glumes, covered by a membrane which flakes away as sterile cells (not found in sori of old specimens) revealing a granular

spore mass surrounding a well formed columella ; sterile cells throughout the sorus, globose-ellipsoidal, singly, in pairs or groups, slightly tinged very light brown, 9–17 μ diam. ; spores globose–subglobose, olivaceous-brown with a dark reddish-brown epispore, 7–10 μ diam., finely but evident verruculose to echinulate.

Type host and locality.

On Andropogoneae : *Sorghum vulgare* Pers. v. *caffrorum* (Thun.) Hubb. et Rehder. (*Sorghum caffrorum* Beauv.), Tanganyika Territory.

Distribution : Venezuela and Tanganyika Territory.

Sphacelotheca Zilligii Zundel, Mycologia **22** : 142. 1930.

Sori in the inflorescence, solitary, long linear, at first concealed by the sheath, 1–3 cm. long, covered by an evident brown false membrane which flakes away revealing a dark brown, granular spore mass surrounding a well developed, much branched, columella ; sterile cells globose–subglobose, hyaline, usually in groups or chains, angular by compression, variable in size, 8–14 μ diam. ; spores globose–subglobose, semi-regular, light reddish-brown, 7–10 μ diam., medium echinulate under oil immersion.

Type host and locality : On *Cymbopogon* sp., Vryburg, Cape Province, Union of South Africa.

On Andropogoneae : *Cymbopogon* sp., Cape Province (M.H. 20666).

Distribution : Reported only from type locality.

Sphacelotheca Pappophori (Pat.) Zundel n.n.

Ustilago Pappophori Pat. Bull. Soc. Myc. (France) **22** : 199. 1906.

Ustilago Pappophori Sydow, Ann. Myc. **24** : 265. 1926.

Sori in the ovaries, causing complete destruction, ovoid, about 1–1.5 by 5–8 mm., covered by a false membrane which flakes away as sterile cells revealing a dark brown spore mass surrounding a columella ; sterile cells abundant, subglobose ellipsoidal, often irregular, about the size of the spores, singly or in groups, hyaline or tinged yellow ; spores globose subglobose, occasionally ellipsoidal, light olivaceous-brown with a narrow, dark. reddish-brown epispore, 7–11 μ diam., finely but abundantly verruculate.

Type host and locality : On *Pappophorum scabrum* Kunth, Selah ad Ahaggar, Algeria.

On Festuceae : *Enneapogon* sp. (M.H. 17279), South West Africa ; *Pappophorum scabrum* Kunth,* South Africa.

Distribution : Algeria, Tunis, South Africa.

Sphacelotheca Nyassae (H. and P. Sydow) Zundel, Mycologia **22** : 133. 1930.

Ustilago Nyassae H. and P. Sydow, Ann. Myc. **18** : 156. 1920.

Sori in the ovaries which remain about normal size, inconspicous, concealed by the glumes, 5 mm. long, covered by an evident false membrane which ruptures revealing a brown, powdery spore mass surrounding a simple columella ; false membrane disintegrating into hyaline, globose sterile cells, 11–16 μ diam. ; spores globose subglobose, sometimes angular, reddish-brown, 9–12 μ diam., under oil immersion finely verruculose and coarsely vacuolated.

Type host and locality : On *Andropogon* sp., Nyassa-Hochland, Station Kyimbila, Nyasaland Protectorate.

On Andropogoneae : *Andropogon* sp., Nyasaland Protectorate.

Distribution : Not reported except from type locality.

Sphacelotheca monilifera (Ellis and Ev.) G. P. Clinton, Jour. Myc. **8** : 141. 1902.

Ustilago monilifera Ellis and Ev. Bull. Torrey Club **22** : 362. 1895.

Sori in the ovaries of the spikelets, 5–7 mm. long or about the length of the glumes, at first concealed by the glumes, covered with an evident false membrane that flakes away revealing a brownish-black spore mass with evident columella ; cells of the false membrane

adhering semi-permanently, interior sterile cells globose subglobose, singly, in pairs or in groups, 9–14 μ diam., tinted light yellowish-brown; spores globose–subglobose, usually regular but sometimes angular, olivaceous-brown, 9 14 μ diam., under oil immersion minutely verruculose or echinulate.

Type host and locality: On *Heteropogon contortus* (L.) Roem. et Schultz (*Andropogon contortus* Linn.), Tucson, Arizona, United States.

On Andropogoneae: *Heteropogon contortus* (Linn.) Roem. et Schultz, Tanganyika Territory.

Distribution: South-Western United States, Mexico, Hawaii, Tanganyika Territory

Sphacelotheca pretoriense (Pole-Evans) Zundel n.n.

Ustilago pretoriense Pole-Evans, Ann. Myc. **12**: 263. 1914.

Sori destroying the inflorescence, 1.5–2 cm. long, tubular, covered with a dark brown membrane which dehisces apically revealing a brown spore mass surrounding a well formed columella; sterile cells 7 13 μ diam., globose ellipsoidal, somewhat irregular, usually granular, hyaline; spores globose broadly ellipsoidal, regular light reddish-brown, 7 13 μ diam. but chiefly 10-13 μ, echinulate to spiny.

Type host and locality: On *Urochloa helopus* Stapf, Pretoria, Transvaal, (M.H. 7408)

On Paniceae: *Urochloa helopus* Stapf. (=*Panicum Helopus* Trin.), Transvaal (M.H. 7799, 8926).

Distribution: Transvaal.

Sphacelotheca modesta (Sydow) Zundel n.n.

Ustilago modesta Sydow, Ann. Myc. **33**: 231. 1935.

Sori in the ovaries, causing complete destruction, covered by a delicate yellowish membrane which flakes away as sterile cells disclosing a dark brown spore mass surrounding a columella; sterile cells abundant, subglobose ellipsoidal, singly, in pairs or in chains, hyaline, vacuolated, usually 5 x 7 μ, occasionally larger; spores globose subglobose, rarely ellipsoidal, olivaceous-brown with a reddish-brown epispore, 10 14 μ diam., abundantly but minutely verruculose.

Type host and locality: On *Enneapogon brachystachyus* Stapf, Prieska, Cape Province Union of South Africa.

On Festuceae: *Enneapogon brachystachyus* Stapf, Cape Province (M.H. 23506).

Distribution: Reported only from type locality.

Sphacelotheca flagellata (Sydow) Zundel n.n.

Ustilago flagellata Sydow, Ann. Myc. **9**: 144. 1911.

Sori destroying the inflorescence, forming along the rachis as a long columella, 8-30 cm. long, at first covered by a brown membrane which later flakes away as sterile cells and revealing a dark brown spore mass; spores globose subglobose, dark brown, 10-14 μ diam., minutely echinulate; sterile cells globose subglobose, in groups or chains, hyaline, 10-14 μ diam.

Type host and locality: On *Rottboellia exaltata* Linn., Province Rizal, Luzon, Philippine Islands.

On Andropogoneae: *Rottboellia exaltata* Linn., Tanganyika Territory; *Rottboellia compressa* Linn. f. Transvaal (M.H. 20331.)

Distribution: Philippine Islands and Tanganyika Territory, South Africa.

This species differs from *Sphacelotheca columellifera* (Tul.) Cif. mainly in having larger darker coloured and finely echinulate spores.

Sphacelotheca Stuhlmanni (P. Henn.) Zundel, Mycologia **22**: 136. 1930.

Sori in the ovaries, long linear, usually 7–10 cm. long, covered with an evident brown false membrane which flakes away disclosing a brown, somewhat agglutinated spore mass

sterile tissue disintegrating into large groups of sterile cells ; often in chains which sometimes collapse, tinted brown ; spores globose–subglobose, sometimes angular, thick walled, reddish-brown, 9–14 μ diam., under oil immersion minutely echinulate.

Type host and locality : On *Andropogon* sp., Ukami, Mrigogo, Central Africa.

On Andropogoneae : *Andropogon* sp., Tanganyika Territory.

Distribution : Central Africa and Tanganyika Territory.

Melanopsichium G. Beck, Ann. Nat. Hofmus. Wien **9** : 122. 1894.

Sori on various parts of the host, firmly agglutinated and conspicuous spore masses ; spores simple, developed in irregular chambers or groups arising from a mixture of plant tissue and fungous threads, thus giving a tubercular character to the sorus, enveloped by a more or less permanent gelatinous envelope, discharging from spore mass by absorption of water, of medium size ; germination as in *Ustilago*.

Type : *Ustilago austro-americanum* Speg.[1], on *Polygonum incarnatum* auct., [2]Missouri, United States. (Rabenh. Fungi Eur. No. **3501**.)

Melanopsichium austro-americanum (Speg.) G. Beck, Ann. Nat. Hofmus. Wien **9** : 122, 1894.

Ustilago austro-americanum Speg. Anal. Soc. Ci. Argent. **12** : 63. 1881.

Sphacelotheca austro-americanum Liro, Anal. Acad. Sci. Fennicae, Ser. A., **17** : 124. 1921.

Sori usually in the inflorescence, occasionally on the leaves and then smaller, forming irregular lobed masses arising from fusion of infected parts, forming a hard agglutinated spore mass mixed with plant tissue ; spores subglobose-ellipsoidal, often irregular with more or less evident gelatinous envelopes, light golden brown, chiefly 7–14 μ diam., smooth.

Type host and locality : On *Polygonum acre* HBK., Argentina.

On Polygonaceae : *Polygonum lapathifolium* L. v. *glabrum* Burtt Davy, Natal (M.H. 20435).

Distribution : North America, South America, Europe, Asia, Africa.

The South African specimen is a rather unusual form with the sori on the leaves.

Cintractia Cornu, Ann. Sci. Nat. VI. **15** : 279. 1883.

Anthracoidea Bref. Unters. Gesammt. Myk. **12** : 144. 1895.

Sori on various parts of the host, often in the ovaries, forming a black, usually rather firm, agglutinated, spore mass ; spores simple, usually of medium or large size and of reddish-black colour, formed in a centripetal manner from fertile stroma usually surrounding a central columella of plant tissue, often freed from sorus by absorption of water ; germination apparently of a modified *Ustilago* type.

Type : *Ustilago axicola* Berk., on *Cyperus* sp.[3], North America.

Cintractia Melinis Zundel n. sp.

Sori destroying the ovaries, about 1 mm. long, at first agglutinated but later somewhat powdery ; spores globose ellipsoidal, irregular, somewhat angled, reddish-brown, 7–11 μ diam., apparently smooth but minutely echinulate under oil immersion lens.

Hab. in ovaries of *Melinis tenuinervis* Stapf, Capetown, Cape Province, Union of South Africa, Coll. C. W. Malley. June 12, 1914. M.H. **19860**.

Latin description :—

Soris ovaria destruentibus, ca. 1 mm., primum conglutinatis, deinde subpulverulentis ; sporis globosis v. ellipsoideis, irregularibus, subangularibus, rubro-brunneis, 7–11 μ diam., specis levibus sed minute echinulatis (sub oleo visis).

Hab. in ovariis *Melinis tenuinervis* Stapf, Capetown, Cape Province, in Unione Africae australis, Coll. C. W. Malley, June 12, 1914. M.H. **19860**.)

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[1] The original type of *U. austro-americanum* was described form South America by Spegazzini in Anal. Soc. Ci. Argent. **12** : 63. 1881.

[2] *Polygonum incarnatum* Auct. is now considered to be *P. lapathifolium* Linn.

[3] Clinton suggests, Proc. Boston Soc. Nat. Hist. **31** : 397. 1904, that this was really *Fimbristylis*.

Sorosporium Rudolphi, Linnaea **4** : 116. 1829.

Sori in various parts of the host, forming dusty dark coloured spore masses; spore balls composed of numerous fertile cells; often rather loosely united and frequently at maturity completely separating, of medium size; spores usually olive or reddish-brown, of medium size; germination similar to that of *Ustilago*, sometimes with elongated germ thread and no sporidia.

Type: *Sorosporium Saponariae* Rud., on *Saponaria officinalis*, Germany.

* Spores smooth.

Sorosporium pretoriaense Zundel, Mycologia **22** : 146. 1930.

Sori in the inflorescence, 3–8 mm. long, broad at the base, covered by a delicate false membrane which flakes away revealing a brown granular spore mass surrounding a well developed columella; spore balls broadly ellipsoidal, opaque, dark reddish-brown, many spored, temporary, usually 38–66 μ, rarely 85 μ diam.; spores globose-subglobose, light olivaceous- brown with a thick yellowish wall, 5–7 μ diam., smooth, contents granular to vacuolated.

Type host and locality: On *Cymbopogon plurinodis* Stapf, Pretoria, Union of South Africa.

On Andropogoneae: *Cymbopogon plurinodis* Stapf, Transvaal (M.H. 10045).

Distribution: Reported only from type locality.

Sorosporium Holstii P. Henn. Pflanzenw. Ost-Afrikas Nachb. C: 49. 1895

Sori in the inflorescence, long linear, 7 mm. long, covered by an evident false membrane which flakes away revealing a brown granular spore mass surrounding a well developed columella; spore balls subglobose–broadly ellipsoidal, opaque, many spored, 50–111 μ diam.; spores globose subglobose, light reddish-brown, 5–8 μ diam., smooth.

Type host and locality: On *Themeda triandra* Forsk. (= *Themeda Forskalii* Hack.), Tanganyika Territory (German East Africa).

On Andropogoneae: *Cymbopogon elegans* Spreng., Nyasaland Protectorate; *Themeda triandra* Forsk. (= *Themeda Forskalii* Hack.), Nyasaland Protectorate, Transvaal, Tanganyika Territory, Transvaal (M.H. 9315).

Distribution: Eastern and Southern Africa.

Sorosporium consanguineum Ellis and Ev. Jour. Myc. **3** : 56. 1887.

Ustilago Aristidae Peck, Bull. Torrey Club **12** : 35. 1885. Not *Sorosporium Aristidae* Neger.

Sorosporium Bornmulleri P. Magn., Ver. Zool.-Bot. Gesell. (Wien), **50** : 434. 1900.

Sori in the ovaries, almost entirely concealed by the glumes though often somewhat visible through them; spore balls subglobose broadly ellipsoidal, often irregular, at first firm but with age and in old specimens separating and becoming entirely broken down, usually 60–130 μ diam.; spores ovoid-subglobose but chiefly polyhedral, reddish-brown, mostly 6–8 μ diam., smooth.

Type host and locality: On "*Aristida Rusbyi*" (*A. arizonica* Vasey).

On Agrostideae: *Aristida junciformis* Trin. et Rupr., Natal (M.H. 1592, 9763).

Distribution: Central and South-Western United States, Australia, South Africa.

Sorosporium Cenchri (Bref.) Zundel n.n.

Tolyposporium Cenchri Bref., Unters. Gesammt. Myk. 12 : 156. 1895.

Sori in the ovaries, destroying and filling them with spores, concealed by the glumes, covered by a membrane which breaks away revealing a granular spore mass; spore balls subglobose-ellipsoidal frequently irregular, opaque, permanent, relatively few spored, small, 25–35 μ long, occasionally 60 μ; spores globose–subglobose, frequently angled due to compression within the spore ball, olivaceous-brown, usually 7–8 μ diam., occasionally 10 μ, smooth.

Type host and locality: On *Cenchrus echinatus* Torrey, Rio de Janeiro, Brazil.
On Paniceae: *Cenchrus ciliaris* L., Transvaal (M.H. 8893).
Distribution: Brazil and South Africa.

Sorosporium inconspicuum (Pole-Evans) Zundel n.n.
Ustilago inconspicua Pole-Evans in herb.

Sori destroying the ovaries and filling them with a brown, granular mass of spores, about 2 mm. long; spore balls dark-brown, opaque, many spored, semi-permanent, generally ellipsoidal or irregular, 100-120 μ long; spores globose subglobose, often angular, light olivaceous-brown, 7 9 μ diam., smooth.

Type host and locality: On *Digitaria monodactyla* Stapf.
On Paniceae: *Digitaria monodactyla* Stapf, Transvaal (M.H. 9416, 10716).
Distribution: Reported only from type locality.

This species is very closely related to *Sorosporium setariae* McAlpine, but differs in having smaller spores.

Sorosporium Everhartii Ellis and Gall. Jour. Myc. **6**: 32. 1890.
Uredo Syntherismae Rav. (not Schw.) Rav. Fung. Car. II. 90. 1853.
Ustilago Cesati Fisch. v. Waldh. Aperçu 25. 1877. p.p.
Tolyposporium Everhartii D'et. Nat. Pflanz. **11**: 14. 1897.

Sori in the ovules of the spikelets, long linear, 1 2 cm. long, ½ cm. wide, at first concealed by the glumes, covered with an evident false membrane which dehisces from the apex revealing a granular dark brown spore mass; spore balls globose-ellipsoidal, opaque, dark reddish-brown, rather permanent, many spored, usually 40 125 μ diam. or occasionally 140 μ; spores globose subglobose, somewhat irregular and angled, reddish-brown (spores on inner part of spore ball lighter coloured, sometimes almost hyaline), 7-12 μ diam., free surface of outer spores verruculose otherwise smooth.

Type host and locality: On *Andropogon virginicus* Linn., Newfield, New Jersey, United States.
On Andropogoneae: *Hyparrhenia Ruprechtii* Fourn., Transvaal (M.H. 7770).
Distribution: Eastern United States, Congo, South Africa.

Sorosporium[1] **verecundum** (Sydow) Zundel n.n.
Ustilago verecunda Sydow, Ann. Myc. **33**: 231. 1935.

Sori entirely destroying the ovaries, about 2 mm. long, almost entirely concealed by the glumes, covered by a lemon-yellow false membrane which flakes away revealing a dark brown agglutinated spore mass: spore balls subglobose ellipsoidal, many spored, opaque, disintegrating at maturity, 42–66 μ long, occasionally 102 μ long; spores globose subglobose, somewhat angled by compression, olivaceous-brown with a narrow reddish-brown epispore, 7-12 μ diam., rarely 14 μ smooth.

Type host and locality: On *Urochloa helopus* Stapf; Wonderboom, Pretoria, Transvaal.
On Paniceae: *Urochloa helopus* Stapf, Transvaal (M.H. 26609).
Distribution: Reported only from type locality.

Sorosporium Zundelianum Ciferri, Nuovo Giron. Bot. Ital. n.s. **40**: 268. 1933.
Ustilago tumefaciens P. Henn. Pflanzenw. Ost-Afrikas C. **5**: 48. 1895.
Sorosporium tumefaciens[2] Zundel, Mycologia **22**: 149. 1930. p.p.

Sori destroying the inflorescence, concealed by the glumes, 1–2 cm. long, long linear somewhat tubular, covered by an evident false membrane which flakes away disclosing

[1] In order to find spore balls it is necessary to secure material from the base of the sorus. The spore balls at the tip of the sorus are usually entirely disintegrated.

[2] Not *Sorosporium tumefaciens* McAlpine, Smuts of Austr. 184, 1910, (on *Stipa* sp. and *Stipa pubescens* R. Br. in Queensland, Australia).

a dark brown granular spore mass: spore balls globose–ellipsoidal, irregular, opaque, dark brown, many spored, semi-permanent (may be almost entirely disintegrated in old mature specimens), 35–95 μ long; spores globose-ellipsoidal, irregular, often angular, 9–12 μ diam., outer spores echinulate to verruculate on free surface, inner spores mostly smooth.

Type host and locality: On *Hyparrhenia rufa* Stapf (=*Andropogon rufus* Kunth), Kilimandscharo, Rombo, Tanganyika Territory (formerly German East Africa).

On Andropogoneae: *Hyparrhenia rufa* Stapf (=*Andropogon rufus* Kunth), Tanganyika Territory; *Hyparrhenia Tamba* Anders., Natal (M.H. 14167).

Distribution: Southern and Eastern Africa.

Sorosporium Tembuti P. Henn. and Pole-Evans, Bot. Jahrb. (Engler) **41**: 270. 1908.

Sori destroying the inflorescence, 1–3 cm. long or occasionally slightly longer, covered by a false membrane which flakes away revealing a dark brown granular spore mass surrounding a well developed columella; spore balls globose–oblong, opaque, with 60 or more spores, dark brown, 40–90 μ diam.; spores globose–subglobose, sometimes angled, medium to light reddish-brown (spores on inner part of spore ball lighter in colour), 9–11 μ diam. rarely 14 μ, outer spores echinulate on free surface, inner spores smooth.

Type host and locality: On *Hyparrhenia Tamba* Anders., Waterval Onder, Transvaal. (M.H. 169).

On Andropogoneae: *Hyparrhenia Tamba* Anderss. Transvaal (M.H. 169, 1794, 1849).

Distribution: South Africa.

Sorosporium setariae McAlpine, Smuts of Australia 183. 1910.

Sori in the ovaries filling them with a brown mass of spores; spore balls dark-brown, opaque, many spored, variously shaped, globose–subglobose to ellipsoidal, often angled, usually 85–125 μ long, occasionally 160 μ long, semi-permanent; spores globose–subglobose often angular, light olivaceous-brown, 10–12 μ diam., smooth.

Type host and locality: On *Setaria glauca* Beauv., near Cloncurry, Queensland, Australia.

On Paniceae: *Setaria perennis* Hack., Transvaal (M.H. 17269).

Distribution: Australia, South Africa.

This species differs from *Sorosporium inconspicua* (Pole-Evans) Zundel principally by the larger spores.

** Spores not smooth.

Sorosporium austro-africanum Zundel, Mycologia **22**: 147. 1930.

Sori in the inflorescence, long linear, 5–8 mm. long, solitary, covered by an evident yellowish false membrane which dehisces at the apex disclosing a granular spore mass surrounding a well developed columella; spore balls semi-opaque, broadly ellipsoidal, usually 142–190 μ in length but occasionally as small as 47 μ, semi-permanent, many spored, reddish-brown; spores globose–subglobose, irregular, often somewhat angular, light reddish-brown to almost hyaline, thick walled, 6–10 μ diam., usually smooth except spores on the outer portion of spore ball which are verruculose.

Type host and locality: On *Hyparrhenia tampa* Anders., Tugela River, Natal, Union of South Africa.

On Andropogoneae: *Hyparrhenia tamba* Anders., Natal (M.H. 14168).

Distribution: Reported only from type locality.

Sorosporium Healdii Zundel, Mycologia **22**: 147. 1930.

Sori in the inflorescence, concealed by the glumes, attacking the individual flowers and en masse producing a witches' broom-like growth, 2–3 cm. long, covered with a yellowish brown false membrane which dehisces from the apex revealing numerous shreds and a dark brown granular spore mass surrounding a well formed columella; spore balls globose–

broadly ellipsoidal, somewhat irregular, opaque, dark brown, permanent, 30 or more spores, usually 40–70 μ long but occasionally 90 μ long; spores globose–subglobose or broadly ellipsoidal, reddish-brown for the outer spores to almost hyaline for the spores on the inner part of the spore ball, thick walled, 6–10 μ diam., sparingly verruculose under oil immersion.

Type host and locality: On *Hyparrhenia* sp., Pretoria, South Africa.

On Andropogoneae: *Hyparrhenia* sp., Transvaal (M.H. 9732).

Distribution: Transvaal.

Sorosporium afrum Sydow, Ann. Myc. **33**: 232. 1935.

Sori entirely destroying the panicles, covered by a brown membrane which ruptures revealing numerous black shreds and spore balls intermixed, 2·5 c.m long, spore mass dark brown; spore balls globose–subglobose, dense, many spored, semi-permanent; spores globose subglobose, somewhat angled, olivaceous-brown, 7–12 μ diam., apparently smooth but under oil immersion lens showing minute echinulations.

Type host and locality: On *Panicum laevifolium* Hack., Transvaal (M.H. 6579).

On Paniceae: *Panicum laevifolium* Hack., Natal (M.H. 11706), Transvaal (M.H. 608, 8932, 8929, 20335).

Distribution: Union of South Africa.

Sorosporium Hotsonii[3] Zundel, Mycologia **22**: 152. 1930.

Sori in the inflorescence, solitary, 3–5 cm. long, at first hidden by the outer sheath, covered by an evident false membrane which flakes away revealing a brownish granular spore mass intermixed among the shreds; spore balls globose–subglobose, semi-opaque, semi-permanent, reddish-brown, many spored, variable in size, 50–115 μ long; spores globose-subglobose, often somewhat angular, thick walled, light reddish-brown, 8–10 μ diam., under oil immersion abundantly echinulate with vacuolated contents.

Type host and locality: On *Andropogon* sp., Hopefield, Lawley, Transvaal, Union of South Africa.

On Andropogoneae: *Andropogon* sp., Transvaal (M.H. 704).

Distribution: Reported only from type locality.

Sorosporium cryptum McAlpine, Smuts of Australia 176. 1910.

Ustilago cryptum McAlpine, Proc. Linn. Soc. New South Wales **22**: 42. 1897.

Sori in the ovaries of spikelets, hidden by the glumes, about 3 mm. long, covered by a thick membrane of host tissue which ruptures revealing a black spore mass surrounding a columella of host tissue; spore balls evanescent, semi-opaque, many spored, variable in size and shape, spheroidal to ellipsoidal, 50–80 μ diam. or larger; spores globose–subglobose or sometimes ellipsoidal, regular, dark reddish-brown, 8–10 μ diam., apparently smooth but minutely echinulate under oil immersion.

Type host and locality: On *Panicum bicolor* R. Br., Braidwood District, New South Wales, Australia.

On Paniceae: *Echinochloa* sp., Transvaal (M.H. 18186).

Distribution: Australia, Union of South Africa.

Sorosporium Clintonii Zundel, Mycologia **22**: 153. 1930.

Sori in the inflorescence, large, developing in clusters as a "witches broom," large, 2–6 cm. long, and often 5 mm. wide, at first concealed by the glumes, covered with a dark brown false membrane which dehisces apically revealing a granular spore mass intermixed with shreds; spore balls globose–oblong, irregular, often angled as so to appear rectangular, opaque, permanent, many spored, dark reddish-brown, ranging from 47–133 μ long, but

[3] In the original description the author misspelled the species name. Since the specific name is for Dr. J. W. Hotson of the University of Washington, Seattle, the name should not be *S. Hodsonii.*

mostly 66–114 μ long; spores globose–subglobose, irregular, often angled, thick walled, about 1·5 μ, dark reddish-brown (spores on inner part of spore ball lighter colour, mostly tinted brown), 8–17 μ diam., verruculose on free surface.

Type host and locality: On *Hyparrhenia Tamba* Anders., Waterkloof, Pretoria, Transvaal, Union of South Africa.

On Andropogoneae: *Hyparrhenia Tamba* Anders., Transvaal (M.H. 9693).

Distribution: Reported only from type locality.

Sorosporium panici[1] MacKinnon, Jour. and Proc. Roy. Soc. N.S. Wales **46**: 210. 1912.

Sori in the ovaries, at first concealed by the glumes but later protruding, 3 mm. long, covered by a delicate membrane which flakes away revealing a granular spore mass surrounding a well formed columella; spore balls globose–ellipsoidal, somewhat irregular, 60–105 μ long, many spored, semi-permanent, in old or mature specimens almost entirely disintegrating: spores globose subglobose, irregular, somewhat angular, olivaceous-brown, 8·5–11 μ diam., densely echinulate.

Type host and locality: On *Panicum flavidum* Retz., Nyngan Experimental Farm, New South Wales, Australia.

On Paniceae: *Panicum maximum* Jacq., Rhodesia (M.H. 14000), Transvaal (M.H. 20).

Distribution: Australia, South Africa.

Sorosporium proliferatum Zundel, Mycologia **22**: 150. 1930.

Sori as large proliferations in the inflorescence resembling miniature ears of corn (maize), 2–8 cm. long, concealed by large outer glumes, covered by an evident false membrane which flakes away revealing a dark brown, granular spore mass intermixed with shreds; spore balls globose–ellipsoidal or sometimes angular, opaque, many spored, permanent, usually 45–60 μ long, occasionally 85 μ long.

The spores in the outer part of the spore ball dense, dark reddish-brown, while the inner spores are nearly hyaline, somewhat irregular in size and shape, ranging from globose-subglobose, occasionally angled, most commonly 9–12 μ diam., abundantly verruculose under oil immersion.

Type host and locality: On *Hyparrhenia aucta* (Stapf) Stent, Waterval Boven, Union of South Africa.

On Andropogoneae: *Hyparrhenia aucta* (Stapf) Stent, Transvaal (M.H. 11336).

Distribution: Reported only from type locality.

Sorosporium Reilianum (Kuhn) McAlpine, Smuts of Australia 181. 1910.

Ustilago reiliana Kuhn, Rab. Fungi Eur. **1998**. 1875.

Ustilago Reiliana Zeae Pass., Rab. Fungi Eur. **2096**. 1875.

Ustilago pulveracea Cooke, Grevillea **4**: 115. 1876.

Cintractia Reiliana G. P. Clinton, Bull. Ill. Agr. Exp. Sta. **57**: 346. 1900.

Ustilago (*Cintractia*) *Reiliana foliicola* Kell., Ohio State Univ. Natural. **1**: 9. 1900.

Sphacelotheca Reiliana G. P. Clinton, Jour. Myc. **8**: 141. 1902.

Sori occurring in either ♂ or ♀ inflorescence, usually causing complete destruction, covered with an evident membrane of host tissue which ruptures disclosing a brown spore mass and numerous columellae, the sori are frequently covered by proliferations of the tassel or ear; spore balls irregular in shape, generally opaque, dark reddish-brown, easily dis-

[1] Sorosporium Beelii Zundel nov. comb.

Sorosporium panici Beeli, Bull. Jard. Bot. Brux. 8: 7. 1923.

Type host and locality: On *Panicum* sp., Bomba, Congo, Africa.

The name *Sorosporium panici* MacKinnon (1912) has preference over *Sorosporium panici* Beeli (1923). These species differ in size of spore balls and spores. *S. panici* MacKinnon has spore balls 60–100 μ with echinulate spores 8·5–11 μ diameter. *S. panici* Beeli has spore balls 150–180 × 100 μ with smooth spores 6–8 μ diameter. The name Sorosporium Beelii nov. comb. is therefore proposed in place of *Sorosporium panici* Beeli.

integrating at full maturity of spores; spore balls found only in young specimens, 76–150 μ diam.; spores globose–subglobose, occasionally somewhat angled, thick walled, reddish-brown, 9 14 μ diam., abundantly echinulate under the oil immersion.

Type host and locality: On *Sorghum vulgare* Pers., Cairo, Egypt.

On Andropogoneae: *Sorghum vulgare* Pers. v. *caffrorum* (Thun.) Hubb. et Rehd. (=*Sorghum caffrorum* Beauv.), Tanganyika Territory (M.H. 20645); *Sorghum halepense* Pers.*, Natal; *Sorghum* sp., Tanganyika Territory (M.H. 20651); *Zea Mays* Linn., Cape Province*, Natal*, Orange Free State (M.H. 10064), Transvaal (M.H. 11, 505, 1480, 2142, 6586).

Sorosporium Simii[1] P.Henn. and Pole-Evans, So. Afr. Jour. Sci. **12**: 513. 1916.

Sori destroying the inflorescence, long linear, 5–7 cm. long, 1 3 cm. wide, covered with a thick dark brown false membrane which flakes away disclosing a granular spore mass intermixed with numerous long shreds; spore balls globose-subglobose, not permanent, opaque, many spored; sterile tissue rather permanent but breaking up chiefly into groups or sometimes chains of sterile cells, rarely singly, tinted brown or dark brown; sterile cells about the size of the spores; distinctive globose groups of sterile cells consisting of 4-6 cells are scattered through the sori, 19-36 μ diam.; spores globose subglobose, olivaceous to reddish-brown, 9 13 μ diam., under oil immersion, finely echinulate with granular contents.

Type host and locality: On *Sorghum halepense* Pers., Natal, Union of South Africa.

On Andropogoneae: *Sorghum halepense* Pers., Natal (M.H. 8978, 10031); ? *Sorghum* sp., Transvaal (M.H. 11324).

Distribution: Union of South Africa.

Sorosporium filiferum (W. Busse) Zundel.

Tolyposporium filiferum W. Busse, Arb. Biol. Abt. Landw. Forstw. Kaiserl. Gesundheit **4**: 383. 1904.

Sori destroying the ovaries, cylindrical elongate, 1–3 cm. long and 5–10 mm. wide, often curved at the end, covered by a thick membrane which ruptures apically revealing long dark brown shreds and a granular spore mass; spore balls subglobose oblong, opaque, rather permanent, many spored, dark brown, 55–115 μ long; spores globose–subglobose, inner spores light yellowish brown, outer spores dark brown, 9 14 μ diam., inner spores smooth, outer spores papillate on free surface.

Type host and locality: On *Sorghum* cult., Kenya Colony.

On Andropogoneae: *Sorghum vulgare* Pers. v. *caffrorum* (Thun.) Hubb. et Rehder., Union of South Africa.

Distribution: Africa.

Sorosporium versatilis (Sydow) Zundel n.n.

Ustilago versatilis Sydow, Ann. Myc. **33**: 231. 1935.

Sori entirely destroying the inflorescence, oblong, 2–3 cm. long, at first covered by a brownish membrane which dehisces apically revealing a dark brown agglutinated spore mass and elator-like shreds; spore balls permanent, many spored, opaque, usually ovoid but sometimes irregular, usually 65–100 μ long; spores globose–subglobose, somewhat angled due to compression, 10–13 μ diam., dark reddish-brown, under oil immersion abundantly but minutely verruculose.

Type host and locality: On *Panicum longijubatum* Stapf. (=*Panicum proliferum* Lam. var. *paludosum* Stapf.).

On Paniceae: *Panicum longijubatum* Stapf., Cape Province (M.H. 9550.).

Distribution: Reported only from type locality.

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[1] *Sorosporium Simii* is probably related to but very distinct from *Sorosporium reilianum* by the possession of large groups or chains of sterile cells throughout the sori. These groups of sterile cells are very distinctive and usually consist of from four to six cells. The sterile cells found in *Sorosporium reilianum* are from the disintegration of the false tissue that surrounds the sori, and are not scattered through the sorus.

Sorosporium Maranguenense P. Henn., Pflanzenw. Ost-Afrikas Nachb. C : 49. 1895.

Sori in the inflorescence, at first covered by the leaf sheaths but later protruding, 3–6 cm. long, covered by an evident membrane which flakes away revealing a granular spore mass intermixed with shreds ; spore balls subglobose, angular, many spored, semi-permanent, 35–65 μ long ; spores subglobose, angular, irregular, thick walled, light reddish-brown (almost a yellow), inner spores lighter coloured, the thick wall dark reddish-brown, 10–14 μ diam., verruculose on free surface.

Type host and locality : On *Hyparrhenia Tamba* Anderss. (= *Andropogon lepidus* Nees), Tanganyika Territory (German East Africa).

On Andropogoneae : *Hyparrhenia Tamba* Anderss., Tanganyika Territory.

Distribution : Reported only from type locality.

Sorosporium pseudomaranguense Zundel n.sp.

Sori in the inflorescence, 3–5 cm. long, at first concealed by the sheath, later the tips protrude, covered by an evident membrane which flakes away revealing a dark brown spore mass ; spore balls ovoid–ellipsoidal, dense, many spored, semi-permanent, 35–85 μ diam. ; spores subglobose, angular, irregular, olivaceous-brown with a thick reddish-brown epispore, 10–14 μ diam., outer spores densely verruculose on the free surface, inner spores smooth.

Hab. in the inflorescence of *Andropogon* sp., Mooi River, Natal, Union of South Africa, Coll. A. O. D. Mogg, March 21, 1917. (M.H. 10073.) Host det. by Agnes Chase, Smithsonian Institute, Washington, D.C.

This species is closely related to *Sorosporium maranguensis* P. Henn.

Latin description :

Soris in inflorescentia, 3–5 cm. longis, primum spatha tectis, deinde apicibus protrudentibus, membrana conspicua tectis, membrana decadenti et atro-brunneum sporarum globum revelante ; glomerulis sporarum ovoideis v. ellipsoideis, densis, multisporis, semi-permanentibus, 35–85 μ diam. ; sporis subglobosis, angularibus, irregularibus, olivaceo-brunneis, 10–14 μ diam. ; episporio denso, irregulari, rubus-brunneo ; sporis externis in superficie dense verruculosis, sporis internis levibus.

Hab. in inflorescentae *Andropogonis* sp., Mooi River, Natal, in Unione Africae australis. Hospes ab Agnes Chase det.

Sorosporium Flanaganianum Zundel, Mycologia **22** : 155. 1930.

Sori in the inflorescence, broad, long linear, 2–4 cm. long, solitary, covered by a thick brown false membrane which flakes away revealing a brown granular spore mass intermixed with fine shreds ; spore balls globose–subglobose, semi-permanent, opaque, dark reddish-brown, usually 75–95 μ long, rarely as small as 47 μ, spores subglobose, irregular, angular, reddish-brown, 10–14 μ diam., echinulate under oil immersion.

Type host and locality : On ? *Andropogon* sp., Emmasdale, Heidelberg, Transvaal, Union of South Africa.

On Andropogoneae : ? *Andropogon* sp., Cape Province (M.H. 9423), Transvaal (M.H. 713).

Distribution : South Africa.

Sorosporium harrismithense Zundel, Mycologia **22** : 154. 1930.

Sori in the inflorescence, 3–4 cm. long, 5–6 mm. wide, solitary, covered by a brown false membrane which dehisces apically revealing a granular spore mass intermixed with numerous shreds ; spore balls globose–subglobose, opaque, semi-permanent, dark reddish-brown, 47–105 μ long ; spores globose–broadly ellipsoidal, angular, thick walled, reddish-brown, 10–14 μ diam., echinulate under oil immersion.

Type host and locality : On *Panicum laevifolium* Hack., Harrismith, Union of South Africa.

On Paniceae : *Panicum laevifolium* Hack., Orange Free State (M.H. 1473).

Distribution : South Africa.

Tolyposporium Woronin, Abh. Senck. Nat. Ges. **12** : 577. 1882.

Sori usually in the inflorescence, more especially in the ovaries, forming a granular spore mass at maturity; spore balls dark coloured, composed of numerous spores permanently united, of medium size; spores bound together by ridged folds or thickenings of their outer walls, of small to medium size; germination about as in *Ustilago*.

(Upon rupture, by pressure, of the spore balls the thickenings or ridges often show as reticulations or as spine-like processes at the margins of the lighter coloured spores. There is a tendency to put species of *Sorosporium* with rather permanent spore balls into this genus.)

Type: *Sorosporium Junci* Schröt., on *Juncus bufonius* Linn., Germany.

Tolyposporium tristachydis (Sydow) Zundel n.n.

Sorosporium tristachydis Sydow, H. & P. Bot. Jahrb. (Engler) **45** : 263. 1910.

Sori in the ovaries, hidden by the outer glumes, at first covered by a delicate membrane which ruptures revealing a granular spore mass; spore balls permanent, held firmly together by outer folds in the spores, many spored, globose to ellipsoidal, dark reddish-brown, usually 50–80 μ diam., occasionally 109 μ; spores globose–subglobose or ellipsoidal, somewhat angular, reddish-brown (spores on the inner part of the spore balls lighter coloured), 10–15 μ diam., smooth.

Type host and locality: On *Tristachya* sp., Leimde, Cameroon, Africa.

On *Tristachya Rehmanni* Hack., Transvaal (M.H. 9436).

Distribution: Africa.

A portion of the type specimens from the Clinton herbarium has been used for this description.

Family II.—TILLETIACEAE.

Tilletia Tulasne Ann. Sci. Nat. Bot. III. **7** : 112–113. 1847.

Sori in various parts of the host, usually in the ovaries but occasionally on the leaves, forming a dusty spore mass; spores simple, usually formed singly in the ends of the mycelial threads that disappear more or less completely through gelatinization, of medium to large size: germination usually by a short non-septate promycelium which bears a terminal cluster of elongated sporidia that usually fuse in pairs which may, in nutrient solution, give rise to a considerable mycelium bearing secondary air conidia.

Spores are formed from hyphae, which swell up in a gelatinous manner.

Type *Uredo Caries* DC. on *Triticum vulgare* Linn., Europe.

Tilletia foetans (B. & C.) Trel. Wisc. Acad. Sci. Trans. **6** : 139. 1886.

Ustilago foetans Berk. & Curt. Rav. Fungi Carol. **100**. 1860.

Ustilago foetans Berk. & Curt. Hedwigia **3** : 59. 1874.

Tilletia laevis Kuhn, Rabenh. Fungi Eur. **1697**. 1873.

Sori in the ovaries, foetid, ovate-oblong, 5–7 mm. diam., protruding between the protecting glumes, when ruptured revealing a brownish spore mass; spores globose–subglobose or elliptical, often somewhat angled, light to dark olivaceous-brown, 16–21 μ diam., smooth.

Type host and locality: On *Triticum vulgare* Vill., North Carolina, United States.

On Hordeae: *Triticum vulgare* Vill., Cape Province, Transvaal (M.H. 1909).

Distribution: Co-extensive with cultivated wheat.

Tilletia heterospora (P. Henn.) Zundel n.n.

Ustilago heterospora P.Henn. Pflanzenw. Ost-Afrikas Nachb. C. **5** : **48.** 1895.

Tilletia Ayresii Berk.[1], Massee in Bull. Misc. Inf. Kew 153 : 146. 1889. (Type on *Panicum maximum* Nees, hill above Port Lewis, Mauritius. Ayes No. **4754**. Type in Kew Herbarium.)

Sori in the ovaries, ovoid, inflated, 3–5 mm. diam., covered by an olivaceous, leathery membrane which ruptures revealing a dark olivaceous, semi-agglutinated spore mass; sterile spores globose–subglobose, hyaline, spiny, of two general sizes, 10–12 μ and 19–21 μ diam.; bifurcate conidiophores abundant; spores globose subglobose, regular, light olivaceous-brown, usually 13–16 μ diam., coarsely echinulate to spiny.

Type host and locality: On *Panicum maximum* Nees, Tanganyika Territory.

On Paniceae: *Panicum laevifolium* Hack., Transvaal (M.H. 7); *Panicum maximum* Jacq., Mauritius, Natal (M.H. 15443, 17081), Portuguese East Africa (M.H. 8399), Rhodesia, Tanganyika Territory; *Panicum* sp., Transvaal (M.H. 11717).

Distribution: Africa, Islands of Indian Ocean.

Tilletia Tritici (Bjerk.) Wint. Rab. Krypt.-Fl. **11** : 110. 1881.

Lycoperdon Tritici Bjerk. Kgl. Schned. Akad. Wiss. Abhandl. **37** : 326. 1775.
Uredo caries DC. Fl. Fr. **6** : 78. 1815.
Caeoma segetum Nees, Syst. Pilze **1** : 14. 1817.
Uredo sitophila Ditm. Sturm's Deuts. Fl. III. **1** : 69. 1817.
Uredo foetida Bauer, Ann. Sci. Nat. Bot. I. **2** : 167. 1884.
Caeoma sitophilum Link, Willd. Sp. Pl. **62** : 2. 1825.
Erysibe foetida Wallr. Fl. Crypt. Germ. **2** : 213. 1833.
Tilletia caries Tul. Ann. Sci. Nat. Bot. III. **7** : 113. 1847.
Ustilago sitophila Bon. Kennt. Con. Crypt. 27. 1860.

Sori in the ovaries, showing between the glumes, 5–6 mm. long, upon rupturing disclosing a reddish-brown spore mass; sterile cells few, subglobose, hyaline, thin walled, 14 μ diam.; spores globose–subglobose, regular, light to dark olivaceous brown, 16 20 μ diam. or slightly larger occasionally, winged reticulations about 1 μ high and 2–3 μ broad.

Type host and locality: On *Triticum vulgare* Vill., Sweden.

On Hordeae: *Triticum vulgare* Vill., Cape Province, general through region.

Distribution: Co-extensive with cultivated wheat.

Tilletia Viennotii Syd. Ann Myc. 35; 2589 25, 1937.

Sori filling the ovaries with a dark coloured spore mass, diseased ovaries larger than normal ones, hidden by the glumes; spores globose–subglobose, regular, with irregular polygonal reticulations, dark reddish-brown, 18 25 μ diam., reticulations projecting on the margin of the spores, 3–3·5 μ.

Type host and locality: *Briza maxima* Linn., Madeira Islands.

On Festuceae: *Briza maxima* Linn., Capetown, (M.H. **14679**)

Distribution: Madeira Islands, South Africa.

Tilletia transvaalensis Zundel, Mycologia **23** : 299. 1931.

Sori in the ovaries, about 1 mm. long, at first concealed by the glumes but later the tip protrudes slightly, infected spikelets scattered throughout the panicle; hyaline sterile cells smaller than the spores; spores globose subglobose, regular, yellowish to reddish-brown, 20–26 μ diam., abundantly echinulate under oil immersion.

Type host and locality: On *Eragrostis aspera* Nees, Mucklenburg, Zebediela, Transvaal, Union of South Africa.

On Festuceae: *Eragrostis aspera* Nees, Transvaal (M.H. 25163).

Distribution: Reported only from type locality.

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[1] Miss E. M. Wakefield first called attention to the fact that *Ustilago heterospora* P. Henn. and *Tilletia Ayresii* Berk. were identical in " Notes on Uganda Fungi," Bull. Misc. Inf. Kew 9 : 290, 1920. Berkeley, however, was correct in considering the fungus a *Tilletia*, in Massee, George " A Revision of the Genus Tilletia " Bull. Misc. Inf. Kew 153 : 146, 1899. The Royal Botanic Gardens, Kew, kindly supplied type material of *Tilletia Ayresii* Berk. for examination.

Tuburcinia (Fries)[1] Woronin, emend. Abh. Sensk. Nat. Ges. **12** : 561. 1882. (Fries, Syst. Myc. 3 : 439. 1829.)

Sori usually in the leaves or stems, forming dark coloured often papillate areas, rather permanently embedded in the tissues ; spore balls composed entirely of firmly united fertile cells ; of medium size ; spores usually dark coloured, variable, of medium size ; sometimes preceded by conidia[2], forming a conspicuous white growth on the surface of leaves, hyaline, oblong to ovate.

Type : *Tuburcinia Trientalis* B. & Br., on *Trientalis europaea* Linn., Europe.

To date no species of this genus have been reported from South Africa. They are usually found in cold climates.

Urocystis Rabenhorst, Klotsch, Herb. Viv. Myc. ed. 2. 393. 1856.

Polycystis Lev. Ann. Sci. Nat. III. **5** : 269. May 1846, not *Polycystis* Kutz, Jan. 1846.

Sori usually in the leaves or stems, occasionally in other parts, producing dark coloured usually dusty spore masses ; spore balls permanent, composed of an enveloping cortex of tinted sterile cells and from one to several interior fertile cells, of small to medium size ; spores usually dark coloured, variable, of medium size ; the balls of spores are developed inside coils of hyphae, which become entwined together and swell up in a gelatinous manner ; the central spores on germination give rise to a promycelium, with terminal sporidia which do not as a rule fuse in pairs, but grow out directly into mycelia.

Type : *Erysibe occulta* Wallr., on *Secale cereale* Linn., Europe.

Urocystis Tritici Koern. Hedwigia **16** : 33. 1877.

Tuburcinia tritici Liro, Ann. Univ. Fenn. Aboensis, Ser. A. **1** : 17. 1922.

Sori in the leaves, culms and leaf sheaths as long striae, covered by a leaden coloured membrane which when ruptured reveals a dark brown spore mass ; spores variable in shape, globose-ellipsoidal, often irregular, usually with 1-2 fertile spores, sometimes 3-4, rarely 5, dark reddish-brown surrounded by lighter coloured sterile cells, chiefly 24–32 μ diam. ; spores globose ellipsoidal, dark reddish-brown, 10–17 μ diam., smooth ; sterile cells usually completely enveloping fertile spores, globose-ellipsoidal, pale yellow, 7–12 μ diam., smooth.

Type host and locality : On *Triticum vulgare* Vill., New Holland, Australia.

On Hordeae : *Triticum dicoccum* Schrank.* : Cape Province ; *Triticum durum* Desf.*, Cape Province ; *Triticum turgidum* Linn.*, Cape Province ; *Triticum vulgare* Vill., Cape Province, Transvaal (M.H. 12454, 13050, 13049).

Distribution : Australia, South Africa, Central United States, Japan, India, Egypt, China.

Urocystis Ornithoglossi (Sydow) Zundel n.n.

Tuburcinia Ornithoglossi Sydow, Ann. Myc. **33** : 233. 1935.

Sori in the leaves as inconspicuous lead coloured pustules about 2 mm. long, sometimes becoming confluent and then longer, covered by the epidermis, spore mass dark brown, granular ; spore balls usually with one (rarely two or three) spore entirely surrounded by numerous outer sterile cells, usually 17–24 μ diam., rarely 31 μ ; outer sterile cells globose-subglobose, light olivaceous-brown, about 7 μ diam. ; spores globose-subglobose, dark reddish-brown, 10–14 μ diam.

Type host and locality : On *Ornithoglossum glaucum* Salisb.

On Liliaceae : *Ornithoglossum glaucum* Salisb., Transvaal (M.H. 1888).

Distribution : Reported only from type locality.

[1] Fries in 1829 was the first to use the term *Tuburcinia* as a genus name. In 1882, Woronin emended the genus so that it did not include any of Fries' original species. In 1922, Liro (Uber de Gattung Tuburcinia Fries, Ann. Uvin. Fenn. Aboensis, A. 1: 1–153, 1922) combined the two genera *Urocystis* Rabenh. and *Tuburcinia* Woronin under the one genus *Tuburcinia* Fries. In so doing he includes species that are cytologically and morphologically dissimilar and only adds confusion to the taxonomy of the Ustilaginales.

[2] *Tuburcinia Trientalis* B. & Br. is the only species known to produce conidia.

Entyloma De Bary, Bot. Zeit. **32** : 101. 1874.
Rhamphospora D. D. Cunningham, Sci. Mem. Med. Off. Army India **3** : 32. 1888.

Sori usually in the leaves, generally forming discoloured but little distorted areas, spores simple, produced terminally or intercalary on any part of the fertile mycelium which is intercellular and never entirely disappears through gelatinization, free (sometimes adhering irregularly through pressure), hyaline to yellowish or reddish-yellow, occasionally dark coloured, of medium size ; germination by a short promycelium bearing a terminal group of sporidia which usually conjugate in pairs and produce secondary sporidia or infection hyphae : conidia often present, hyaline usually elongate formed by germination of the spores in situ ; or on the mycelium produced through the stomata.

Type : *Protomyces microsporus* Ung., on *Ranunculus repens*. Germany.

Entyloma Zinniae Sydow. Ann. Myc. **33** : 233. 1935.

Sori as orbicular to irregular spots in the leaves, 2-5 mm. diam., showing best on the upper surface, at first yellowish then brown : spores globose-subglobose, regular, with a regular equal epispore about 2 μ, tinged olivaceous-brown, 8-10 μ diam., occasionally 11 μ.

Type and locality : On *Zinnia pauciflora* Linn.

On Compositae : *Zinnia pauciflora* Linn., Transvaal (M.H. 11256).

Distribution : Union of South Africa.

Entyloma Bidentis P.Henn. Pflanzenw. Ost-Afrikas C. **5** : 49. 1895.

Sori in the leaves, forming roundish brown spots visible on both upper and lower surfaces, 2-3 cm. diam., often coalescing, at first yellowish then chestnut brown : spores subglobose, irregular, contents sometimes with small greenish granules, olivaceous yellow, 10-11 μ diam., epispore 1-1·5 μ thick, smooth.

Type host and locality : On *Bidens pilosa* Linn., Tanganyika Territory.

On Compositae : *Bidens pilosa* Linn., Cape Province (M.H. 8853), Tanganyika Territory, Transvaal (M.H. 1508).

Distribution : Eastern and Southern Africa.

Entyloma australe Speg. Anal. Soc. Cien. Argent. **10** : 5. July, 1880.
Protomyces Physalidis Kalchb. Grevillea **9** : 22. Sept., 1880.
Entyloma Besseyi Farl. Bot. Gaz. **8** : 275. 1883.
Entyloma Physalidis Wint. Hedwigia **22** : 130. 1883.

Sori in the leaves and often in the inflated calyx, forming at first light coloured and later darker coloured, slightly raised (on lower side of leaf) spots, roundish, often angular, 0·5-7 mm. or more in diam. : spores globose-subglobose, sometimes angled, with a thick darker coloured epispore, light reddish-brown, 10-15 μ diam., smooth ; conidia forming whitish epi- or hypophyllous growth, linear, somewhat curved, usually 30-55 μ × 1-2 μ.

Type host and locality : On *Physalis hirsuta* Duncan, Argentina.

On Solanaceae : *Physalis minima* Linn., Transvaal (M.H. 1509, 5638, 11008, 14126) : *Physalis peruviana* Linn., Cape Province (M.H. 10028), Transvaal.

Distribution : North America, South America, South Africa.

Entyloma Dahliae H. & P. Sydow, Ann. Myc. **10** : 36. 1919.

Sori as orbicular to elliptical spots on the leaves, pale but definite and conspicuous, 1-10 mm. long ; spores globose, pale olivaceous-brown, evenly coloured including the epispore, 9-14 μ diam., epispore 1-2·5 μ ; conidia unreported.

Type host and locality : On *Dahlia variabilis* Desf., Harden Heights, Natal, Union of South Africa.

On Compositae : *Dahlia variabilis* Desf., Natal (M.H. 86C, 19761), Transvaal (M.H. 18023).

Distribution : Europe, Central America, South Africa, South Rhodesia.

APPENDIX A.

The following species have been reported from South Africa and adjacent territory but no specimens have been available for examination.

Sphacelotheca Panici-miliacei (Pers.) Bubak, Naturw. Landes. Böhmen **15** : **26**. 1916.
Uredo segetum panici-miliacei Pers. Synop. Meth. Fung. 224. 1801.
Uredo carbo Panici miliacei DC. Fl. Fr. **6** : 76. 1815.
Uredo destruens Duby, Bot. Gall. **2** : 901. 1824.
Erysibe Panicorum Wallr., Fl. Crypt. Germ. **2** : 216. 1833.
Ustilago Carbo destruens Lev. Ann. Sci. Nat. III. **8** : 372. 1848.
Ustilago destruens Schlecht. Rab. Herb. Myc. No. 400.
Ustilago panici-miliacei Wint. Rab. Krypt.-Fl. 11 : 89. 1881.
Sorosporium Panici-miliacei Tak. Bot. Mag. (Tokyo) **16** : 183. 1902.

Ustilago Panici-miliacei (Pers.) Wint. Die Pilze p. 89, Schroet. Pilze Schles. p. 268, Bref. Untersuch. V, pag. 97, tab. 7, fig. 9 24, *Uredo* (*Ustilago*) *segetum* var. *Panici-miliacei* Pers. Syn. Fung. p. 224, *Uredo Carbo* var. d. DC. Flor. Franc VI, pag. 76, *Caeoma destruens* Schlecht. Fl. Berol. II, p. 130, *Uredo destruens* Duby Bot. Gall. II, p. 216, n. 1670, *Ustilago Carbo* var. *destruens* Tul. Ann. Sci. Nat. III. **7** : 81. 1847, *Tilletia destruens* Lev. Ann. Sci. Nat. III. **8** : 372. 1848, *Ust. destruens* Schlecht. in Rabenh. Herb. Myc. nov. n. 400. -- Soris atris, pulverulentis, flores destruentibus : sporis globosis vel ellipsoideis, 9-12 8 10, raro angulatis, episporio flavo-brunneo levi vel punctulato instructis ; promycelio filiformi cylindraceo, plerumque 3-septulato, articulis, anastomosantibus ; oblongo-ellipticis vel ovoideis.*

Hab. in floribus paniculisque *Panici-miliacei*, *P. carthaginiensis* et. *P. Crus-galli*, Gallia, Germania, Amer. bor. (Ravenel) nec non pr. Montivideo Americae australis (Archavaleta sec. Winter). (Saccardo Syll. Fung. **7** : 454–455. 1888.)

Tolyposporium Anthistiriae Cobb. in Agric. Gaz. New South Wales, 1892, p. 1006, cum ic, Syll. XIV, p. 426, *Tolyposporium Anthistirae* P.Henn. Hedwigia 1898, pag. 283.— Sori in spices easque destruentibus, cylindraceis, 2–5 cm. longis, epidermide dein lacerata flavescente tectis ; glomerulis oblongis vel subglobosis aterrimis, 70–100 μ diam. : sporis subglobosis v. ellipsoideis, primo hyalinis, dein cinnamomeis v. atris, 9 14** 8-12, episporio minutae verrucoso-punctulato, 1 μ crasso.

Hab. in spices *Anthistirae* spec. in Africa centr. (Schweinfurth) et Australia (Cobb). — Sec. Cobb loc. cit. massa sporarum 40–150 μ diam. ; cellulae singulae 8–14 μ. longa. Ergo species homonyma posterior cl. Henningsii eadem videtur. (Saccardo Syll. Fung. **16** : 378. 1902.)

Tolyposporium setariicolum H. et P. Sydow Ann. Myc. **10** : 77. 1912. Soris in spicis evolutis easque omnino destruentibus, haud tumefacientibus atris ; glomerulis rotundatis, ellipticis v. forma irregulari, 35-70 μ diam., ex sporis numerosissimis compositis, sub-firmis : sporis angulato-globosis v. angulato-ellipsoideis, brunneis, 7–10 $\times$ 6–9, verrucis facile deciduis obsitis.

Hab. in foliis *Setariae aureae* (Graminaceae), Sidderiberg Kamerun, Africae (C. Ledermann, no. 4803, 30.7.1909) — A *Tol. pampeano* Speg. quoque in *Setaria* omnino diversum. (Saccardo Syll. Fung. **23** : 620. 1925.)

Tolyposporium Penicillariae Bref. Unters. XII, p. 154, tab. IX, fig. 35–40. — Soris in quaque spica solitariis, ovariicolis, bullam magnam globosam efformantibus, nigris, glomerulis sporarum variae magnitudinis ac formae, plerumque subglobosis v. ovoideis ; sporis solitariis dilutioribus, 10–12 μ diam., vix distincte verrucosis, flavo-brunneis : promycelio gracili, 8-loculari ; sporidiolis capiosissimis, ad septu evolutis.

Hab. in inflorescentiis *Penicillariae spicatae*, Simla Indae Orient. (Barclay). (Saccardo Syll. Fung. **14** : 426. 1899.

Uredo pilulaeformis, n.s.; sporis fusco-nigris irregularibus vel subglobosis regosiusculis plus minus connatis conglomeratis immixtis minoribus effactis massam compactam non rimosam efformatibus, *Zeyher*, n. 89.

Destroying the germens of some species of *Juncus*. Uitenhage. December.

Resembling very strongly *U. urceolorum*, and, like that, infesting the germen, and forming little globose or elliptic, pill-like bodies, consisting of a compact mass of deep brown, irregular, subglobose, often angular, more or less connate, slightly rugose spores, mixed with smaller globose, sub-elliptic, hyaline bodies, which appear to be abortive sporidia. They become yellow when treated with iodine, and therefore are not fecula. In the centre of the mass, towards the base, there is sometimes a pale clavate columella, extending half way up the mass, but this is not always present. The surface of the mass is not cracked, at least in the specimens before me.

This species resembles very much *U. urceolorum*, but in that the spores are distinct and echinulate, and they are not mixed with abortive spores, or if so, in a very slight degree. The two species are certainly very nearly allied, but are, I believe, distinct. (Berkeley, M. J. Enumeration of fungi collected by Herr Zeyher in Uitenhage. Jour. Bot. (London) 2 : 523-524. 1843.) See *Cintractia piluliformis* (Berk.) P. Henn.

Ustilago Danthoniae Kalchbr. Grevillea **11** : 18. Sporis globosis 36 μ., granulosis, atro-fusous.

Hab. in spices *Danthoniae papposae*, in summo monte Chumiberg, prope stationem Missionis evangelicae " Lovedale " dictam (Rev. T. Buchanan) - Haud procul distat *Ust.? Salveii*, sed haec soris linearibus folia modo occupat, non vero spicas " An potius *Tilletia ?* ". (Saccardo Syll. Fung. **7** : 373. 1902.)

P. Hennings in Hedwigia **34** : 328. 1895. adds to the description of *Ust. Danthoniae* Kalchbr. as follows: " Die sporen werden von Kalchbrenner mit 36 u im Durchmesser angegeben. Dieselben sind jedoch wie bei den vorliegenden Original Examplaren, kugelig, schmutzigbraun, granulirt, 10-15 μ im Durchmesser." (Saccardo Syll. Fung. **7** : 373. 1902.)

Ustilago Dregeana Tul. in Ann. Sci. Nat. 1847, p. 83, t. III, f. 13, Fisch. Apercu p. 21.

Soris atris, deformantibus; sporis globosis vel ovideo-obtusis, 4–5 μ diam., ex olivaceous brunneo-arantiacis, papillosus.

Hab. in pedunculis inflorescentiae graminis cujusdam in C. Bonae Spei (Drege) et *Cynodontis Dactyli* Somerset East Africae australis (Mac Owan) -- Teste Kalchbrenner in Grevillea **11** : 18 inflorescentiam, adhuc in vagina latentem prorsus deformantam, fungillus pulvere atro obducit. Sed ex Kalchbrenner l.c.; sporae sunt majores, 12–15 μ diam. leviter tuberculatae huic ad aliam speciem forte spectantes. (Saccardo Syll. Fung. **7** : 467. 1888.)

Ustilago Penniseti Rabenh. in Hedwigia 1871, pag. 18, Fisch. Apercu. p. 14, p.p. *Uredo* (*Ustilago*) *trichophora* var. *Penniseti* Kunze in Flora, 1830, p. 369, *Ustilago Carbo* 1 *columellifera* b. *trichophora* Tul. in Ann. Sci. Nat. 1847, p. 81. - -

Soris clausis, firmulus, atris, colulella regida a basi divisa instructis: sporis magnitudine diversissimis, 5·5–12 μ diam., valde irregularites globosis, saepe subangulosis, conglobatis non vel vix punctatis, episporio crassissimo, 1·8-2 μ crasso, brunneis.

Hab. in ovariis *Penniseti dichotomi, vulpini, cenchroidis* et *fasciculati* in Aegypto (Schweinfurth) et insula Maderia (Schroeter). (Saccardo Syll. Fung. **7** : 462. 1888.)

Ustilago piluliformis (Berk.) Tul. in Ann. Sci. Nat. 1847, p. 93, t. V, f. 27-30, *Uredo piluliformis* Berk. Fungi Uitehn. p. 507, t. XXII, f. 6. - -

Sori compactis, atris; sporis vel ovideo-angulatis, 16–20 × 12–16 μ diam. levibus, episporio inaequaliter incrassato, atro, partim hyalinulo.

Hab. in ovariis *Juncorum*, pr. Uitenhage in Africa meridionali (Zeyher). — A *Cintractia Junci* Trel. plane distincta. Species ob sporae maxime glomerato- coalitar, teste Tuslane firsan aptius inter *Thecaphoras militare*. (Saccardo Syll. Fung. 7 : 458–459. 1888.)

See *Cintractia piluliformis* (Berk.) P. Henn. for change of name.

Ustilago Sladenii Pole-Evans nov. spec.

Soris olivaceo-atris, pulverulentis in rachidibus floribusque, eos omnino destruentibus; sporis globosis vel subglobosis 5–6 μ diam., glabris, dilute olivaceis.

In the flowers and branches of the inflorescence of a grass (probably *Ehrharta* sp.) Garies, 1910–11.

H. H. W. Pearson, No. **6728** (Pole-Evans No. **8409**).

Saccardo does not include this species in his Sylloge Fungorum. (South African College. Ann. Bolus Herb. **1** : 115. 1915.)

Ustilago nuda (Jens.) Kell. et Swingle II Rep. Agr. Kans. p. 215 et 277, t. II, f. 7–17. *Ust segetum* Auct. p.p., *Ust. Hordei nuda* Jens. in litt.—

Massa sporarum brunneo-olivacea, laxa mox libera; sporis ovoideis, ellipsoideis vel subglobosis, 5–7 × 5 × 6·5, subolivaceis, germinando promycelium parce ramosum, apicibus saepe inflatum gignentibus; sporidiolis hucusque non visis.

Hab. in ovariis *Hordei vulgaris* in Europa amer. bor. Japonis. (Saccardo Syll. Fung. **9** : 283. 1891.)

Ustilago ugandensis P. Henn. Pilz Ostafr. p. 18. 1895.

Soris atro-olivaceis, epidermide tectis, dein cintis, pulverulentis, ad apicem culmorum in rhachibus florisbuaque, rhachidem curvam contortamque efformantibus; sporis subglobosis, saepe acutangularis, fusco-olivaceis, sublevibus, punctulatis, 6–8 × 5–7.

Hab. in spicis *Panicum* in Africa trop. (Saccardo Syll. Fung. **14** : 414–415. 1899.)

Cintractia capensis (Reess) Ciferri, n. comb. Ann. Myc. **29** : 72. 1931.

Ustilago capensis Reess[1] in Sitzb. phys.-med. Soc. Erlangen 1875, pp. 70–72.

Ovariicola; soris aureo-flavis, pulverulentis, sporis globosis, 15–16 μ diam., episporio reticulato, strato triplici, constituto, interiori tenui, flavido, lineolis areolisque subhyalinis.

Hab. in ovariis *Junci capensis* et *lomatophylli*, e Cap Bonae Spei proveneintium in Bremen Germanae (Buchenau). -

(Saccardo Syll. Fung. 7 : 478. 1888.)

Cintractia leucoderma (Berk.) P. Henn. **34** : 335. 1895.

Ustilago leucoderma Berk. Ann. Mag. Nat. II. **9** : 200. 1852.

Cintractia Krugiana Magn. Bot. Jahrb. (Engler) **17** : 490. 1893.

Cintractia affinis Peck, N.Y. State Mus. Bull. **67** : 28. 1903.

Ustilago leucoderma Berk. Fungi S. Domingo n. 54, Fisch. Apercu p. 16. –

Soris atris maculis magnis insidentibus, consta albida inaequali subvelatis: sporis rotundatis, rarius irregularibus, 13–17 μ diam., opacis, atris, levibus.

Hab. in vaginis foliorum *Caricis* et Cyperaceae (?) cujusdam in St. Domingo et in insula Borneo; in vaginis *Rhynchosporae aureae* ad Ratnapoora. (Saccardo Syll. Fung. **7** : 460. 1888.)

Cintractia piluliformis (Berk.) P. Henn. Hedwigia 1898, p. 293.

Uredo piluliformis Berk. Fg. Uitenh. p. 507, t. XXII, fig. 6.

Ustilago piluliformis Tul. Ann. Sci. Nat. 1847, p. 93, t. V, fig. 27–30, Sacc. Syll. VII, p. 458. —

Soris compactis, stris, globosis, v. cylindricis, duris 1–2 mm. diam.; sporis densis conglobatis, globosis, ellipticis v. ovoideis, initio hyalinis, intus granulatis v. punctatis, filamentis hyalinis intermixtis, dein brunneis, postremo atris, impellucidis, 10–17** 9–14.

Hab. in ovariis *Junci capensis* et *Junci* spec. in Africa austr. et meridionale. (Saccardo Syll. Fung. **16** : 373. 1902.)

[1] Reess, Max. Ueber *Ustilago? Capensis*, einem neuen Brandpilze vom Cap der guten Hoffnung. Sitzungsber. der physic.-medic. Soc. zu Erlangen **7** : 70–72, 1875.

Cintractia tangensis P. Henn. Engl. Bot. Jahrb. XXXVIII (1905), pag. 103.

Soris in axillis foliorum globosis, primo membrana hyalina vestitis, dein pulverulentis, aterrimis, 5 6 mm. c. cr; sporis subglobosis 8–11 μ diam. v. ellipsoidesi et c. 8–12 × 7–8. μ brunneo-olivaceis, intus granulosis, episporio levi.

Hab. in axillis foliorum *Cyperi* sp., Tanga, Usambara, Africa (Tanganyika Territory). (Saccardo Syll. Fung. **21** : 510. 1912.)

Cintractia togoensis P. Henn. Engl. Bot. Jahrb. XXXVIII (1905), pag. 119.

Sori in floribus globosis, duris, atris et paucis subinclusis; sporis subglobosis v. subellipsoideis, intus granulatis, 12–14** 11–13, episporio levi, olivaceo-brunneo; hyphis hyalinis intermixtis.

Hab. in floribus *Cyperi* sp. Togo Camerum, Africae. (Saccardo Syll. Fung. **21** : 510. 1911.)

Cintractia usambarensis (P. Henn.) Ciferri, in Archiv f. Bot. (Stockholm) A. **23** : 7. 1931. *Cintractia leucoderma* (Berk.) P. Henn. Hedwigia 1895, p. 335. (syn. *C. Krugiana* P. Magn.) — Var. *usambarensis* P. Henn. Pilz. Ostafr., p. 48. 1895.

Soris cylindraceis, nigris, 1½ 2 cm. longis, 14–16 mm. latis; sporis majoribus, dense verrucosis, obscurioribus, 15 17 · 14 16 μ.

Hab. in *Rhynchospora aurea* in Africa trop. (Stuhlman). (Saccardo Syll. Fung. **14** : 420. 1899.)

Sorosporium Wildemanianum P. Henn. in Fl. du Bas.-et Moy-Congo. Ann. Mus. du Congo V, II. fasc. II (1907), page. 87.

Soris ovaria staminaque destruentibus, atris epidermide cinerea tectis; glomerulis ellipsoideis v. subglobosis e sporis numerosis compositis, 50–80 ** 50 60; sporis subglobosis v. ellipsoideis fusco-brunneis, verrucosis, 7–10 × 6 9 μ.

Hab. in foliis *Andropogonis* sp. Mbele Congo (Vanderyst). (Saccardo Syll. Fung. 21 : 513–514. 1911. Sept.)

Tuburcinia Eriospermi H. Sydow.

Pustulas orbiculares vel ellipticas 3–6 mm. longas formans; massa sporarum atra, pulverulenta: glomeruli sat regulares, globosi vel subglobosi, 16–22 μ diam., fere semper sporam unicam centralem tantum includentis; sporae globosae, fuscae, 10 13 μ diam., leves; cellulae peripherical numerosae, leves, pallide fuscae, 6 9 μ longae, 4 6 μ altae.

Hab. in foliis *Eriospermi latifolii*, Stellenbosch, 6. 1923. leg. P. A. van der Bijl (no. **1142**). (Ann. Myc. **22** : 237. 1924.)

Entyloma cissigenum P. Henn.[1] Pilz Ost-Afr. p. 49. 1895.

Maculis amphigenis, gregariis, rotundatis, circiter 2 mm. diam., saepe confluentibus, atris; sporis globosis, intus fuscis v. minute viridulis subgranulatis, 18–21 μ crasso.

Hab. in foliis vivis *Cissi* in Africa trop. (Volkens). (Saccardo Syll. Fung. **14** : 423. 1899.)

Entyloma Oleandrae P. Henn. Hedwigia 1895, p. 326.

Soris striiformibus, amphigenis, ca. 1 cm. longis, 2 mm. latis, atris v. atro-violaceis: sporis globosis, raro ellipsoideis, minute granulatis, subhyalinis, 8 12 × 6 10 μ: episporio subfuscidulo.

Hab. in foliis *Oleandrae articulatae*, Natal (Wood). (Saccardo Syll. Fung. **14** : 425. 1899.)

Urocystis Anemones (Pers.) Schröt. form kerguelensis P. Henn. Deutsche Südpolar-Exped. 1901–1903, **8** : 1. 1906.

Kerguelen—Station, an der Pinguinbucht, auf lebenden Stengeln und Blättern von *Ranunculus biternatus* Sm., Dr. E. Werth, leg. 26. Dezember 1902, 9. Januar 1903. Dieser

[1] In the original description the specific name is spelled *E. cissigena*.

in ganz Europa, Nordamerika, Sibirien usw. auf verschiedenartigen Ranunculaceen verbreitete Pilz bildet auf den niederliegenden Stengeln, Blattstielen und Blättern obiger Pflanzen aufgetriebene bis etwa 2 cm. lange, von einer graubraunen Oberhaut bekliedete Brandpusteln, welche bei der Reife durch einen Längsriss aufbrechen und die tiefschwarze Sporenmasse freilegen Dieselbe besteht aus Sporenballen von ellipsoider oder rundlicheckiger Form, die meist 20-30 u Durchmesser besitzen. In der Mitte dieser Ballen finden sich 1-3 rundlich eckige oder ellipsoide Hauptsporen, mit dunkelbrauner, undeutlich punktierter Membran, meist 12-20 u lang, 10–16 u breit. Diese werden meist von zahlreichen heller getärbeten, gelblichen, halfkugeligen oder unregelmässig eckigen, 8 12 u breiten. Nebensporen ungeben, mitunter fehlen diese ganz. Die ganze Pflanze wird durch den Parasiten unförmlich verbildet.

Durch die grösseren Hauptsporen soure durch Nebensporen ist der Pilz von der typischen Form etwas verschieden, ebense von *U. sorosporioides* Körn.

It is doubtful whether *Urocystis Anemones* form. *kerguelensis* described by P. Henning from Kerguelen Island differs from the species other than in slight variations due to host and climate. With further search, this species should be found in South Africa., Saccardo does not list this form in Sylloge Fungorum.

It must be noted that the authority for the species should be *Urocystis Anemones* Pers.) Winter; Rab. Krypt.-Fl. **11**: 123. 1881.

Tilletia Schenckiana P. Henn. Deutche Sudpolar-Exped., 1901–1903, **8**: 2. 1906.

Soris ovariicolis en destruentibus paulo deformantibus, paleis laxe circumdatis, translucentibus, ellipsoideis, firmis, membrana cinereo-fusca vestitis, ca. 1 × 0·5 mm. diam.: sporis ellipsoideis vel subglobosis, 20–30 × 20–24 μ, episporio reticulato, melleo dein fusco-brunneo, ca. 2 3 μ crasso, interdum filis hyalinis, flexuosis, 2–4 μ crassis intermixtis.

Kerguelen im Tale zurschen Station und Mittelberg, in Bluten von *Deschampsia antarctica* E. Desv. Dr. E. Werth, 19 Februar 1903. Diese äussert zierliche Art tritt in den Fruchtknoten, welcher zerstört und wenig verbildet ist, in ellipsoiden, dunklen Sori von den trockenhäutigen Spelzen locker umschlossen auf und auf dem Scheitel der Sori sind oft noch die tädigen Narben erkennbar.

Der Pilz ist sowohl von *Tilletia cerebrina* Ellis et Ev. aus Nord-amerika in Ovarien von *Deschampsia caespitosa* P. B. sowie von T. *Airae Blytt* in *Deschampsia calycina* durch die kleinen sori sowie die Sporen verschieden Der Pilz wurde bei der Bestimmung der Nährpflanze bereits von Prof. Dr. Schenck beobachtet und als, *Tilletia* erkannt.

This smut described from rocky Kerguelen Island should be found in South Africa. It is not known where the type specimen is deposited. Saccardo does not list this species in Sylloge Fungorum.

APPENDIX B.

The following is a list of doubtful and excluded species that have been reported from South Africa and nearby territory.

Ustilago Welwitschiae Bres. in Sacc. Fl. mycol. Lus. p. 68. —

Soris parvis, globosis, fuligineis, pulverulentis, e squamas erumpentibus; sporis fuscidulis, globosis, asperulis, 3½–4 μ diam.

Hab. in squamis conorum *Welwitschiae mirabilis* e Mosamedes Africae allatae in hort. bot Coimbrae (Möller). (Saccardo Syll. Fung. **14**: 411. 1899.) A doubtful smut.

Sorosporium africanum Sydow, Ann. Myc. **7**: 544. 1909.

Soris ovaria occupantibus easque omnino destruentibus, atris, pulverulentis; glomerulis esporis usque 8 compositis, 12–25 μ diam.; sporis globosis vel angulato-globosis, subtilissime verruculosis vel punctatis, olivaceis vel olivaceo-brunneis 5–9 μ diam.

Hab. in ovariis *Panici trichopi* Portugiesich–Ostafrika. 18.4.1908. leg. C. W. Howard.

The portion of the type specimen examined (M.H. **631**, on *Panicum trichopus* Hochst., Portuguese East Africa, coll. C. W. Howard, April 18, 1909) is very poor since there were very few spores and these were not typical of the Ustilaginales, much less a *Sorosporium*. A portion of the type specimen in the Clinton herbarium was examined but it contained no spores.

The original description says that the spore balls are composed of 8 spores. This is not typical of a *Sorosporium*. This fungus is apparently one of the dark spored members of the fungi imperfecti. At any rate we will list it temporarily as an excluded smut until more and better material is available for examination.

Tolyposporium Chloridis P. Henn. Pilz Ostafr. p. 49. 1895.

Soris atris, firmis, bullatis, undulato-plicatis, rugulosis, interdum confluentibus; glomerulis sporarum firmis, varia magnitudine, subglobosis, acutangulis, e 3–5 sporis compositis, 10–20 × 8–15, fusco-brunneis v. atris; sporis acutangulis, sublevibus, 6–10 μ.

Hab. in fructibus *Chloridis abysinicae* in Afric trop. (Volkens). (Saccardo Syll. Fung. 14 : 426. 1899.)

A study of specimens of *Tolyposporium Chloridis* P. Henn. from various parts of southern Africa indicates that the fungus in question is not one of the Ustilaginales but rather one of the dark coloured Hyphomycetes.

The following South African specimens from the Union Department of Agriculture, Mycological Herbarium have been examined: No. 9056, collected by I. B. Pole-Evans, Feb., 1915, at Groenkloof, Pretoria, Transvaal: No. 9770, collected by P. van der Bijl, May 5, 1926, at Mid Illovo, Natal: No. 1627, collected by E. M. Doidge, June 26, 1911, at Mountain Rise near Pietermaritzburg, Natal: No. 17043, collected by A. O. D. Mogg (no. 4290), May 1, 1919, in Zululand. In each case the host was *Chloris gayana*.

Tolyposporium Volkensii P. Henn. Pilz Ostafr. p. 49. 1895.

Soris ad germina pustulatis, submesenteriformibus, atris, subgelatinosis (?), rugulosis circ. 5–8 mm. diam.; glomerulis subglobosis v. irregulariter acutangulis, firmis, 15–28 μ diam., e 3–15 sporis compositis, plus minus fuscis; sporis subglobosis, ovoideis, oblongis, e mutua pressione acutangulis, fusco-brunneis, minute granulatis, 5–11 μ.

Hab. in ovariis *Sorghorum cultorum* in Africa trop. (Volkens).

Mason[1] (1926) worked with type material of *Tolyposporium Volkensii* P. Henn. from East Africa and found that it was not one of the Ustilaginales but was *Cerebella sorghi-vulgaris* Subram. This was later confirmed by Subramanian. "Hennings' species is a true *Cerebella* having a true convoluted stroma with a surface layer of palaside-like conidiophores each bearing at its apex a conidium with septa in three planes."

Species of the Graphiolaceae are excluded. While they are closely related to the Ustilaginales, they are not a family of this order. *Graphiola phoenicis* Poit., the most common species, attacks *Phoenix* sp. both in greenhouses and in the open.

Various species of the genera *Cerebella* and *Ustilaginoidea* are sometimes confused with the smuts. These genera are members of the family Dematiaceae of the imperfect fungi. *Tuberculina*, a member of the Tuberculariaceae of the fungi imperfecti, is another genus that is sometimes put with the Ustilaginales.

[1] Mason, E. W., on two species of *Tolyposporium* Woronin recorded on cultivated *Sorghum*. Rrans. British Myc. Soc. **9** : 284–286. 1926.

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Rhyncospora aurea Vahl
  Cintractia leucoderma (Berk.) P. Henn. (Appendix A.)
  Cintractia usambarensis (P. Henn.) Ciferri (Appendix A.)

Rottboellia compressa L.
  Sphacelotheca densa (McAlp.) Ciferri
  Sphacelotheca flagellata (Syd.) Zundel

Rottboellia exaltata Linn.
  Sphacelotheca flagellata (Syd.) Zundel

Saccharum officinarum Linn.
  Ustilago scitaminea H. Syd.

Scilla Kraussii. Baker.
  Ustilago Vaillanti Tul.

Scilla sp.
  Ustilago Vaillanti Tul.

Setaria aurea A. Br. (see S. sphacelata Stapf & Hubb.)

Setaria italica (L.) Beauv.
  Ustilago Crameri Korn.

Setaria nigrirostris Dur. and Schinz.
  Ustilago Evansii P. Henn.

Setaria perennis Hack.
  Sorosporium Setariae McAlp.

Setaria sphacelata Stapf. & Hubb.
  Tolyposporium setariicolum H. & P. Syd. (Appendix A.)

Setaria sp.
  Ustilago Evansii P. Henn.

Sorghum caffrorum Beauv. (see S. vulgare Pers. var caffrorum)

Sorghum halepense Pers.

Sorosporium Reilianum (Kuhn) McAlp.
Sorosporium Simii P. Henn. and Pole-Evans.
Sphacelotheca cruenta (Kuhn) Potter

Sorghum versicolor Anders.
Sphacelotheca transvaalensis Zundel

Sorghum vulgare Pers.
Sphacelotheca cruenta (Kuhn) Potter

Sorghum vulgare Pers. var. caffrorum (Thum.) Hubb. and Rehder
Sorosporium filiferum (W. Busse) Zundel
Sorosporium Reilianum (Kuhn) McAlp.
Sphacelotheca Holci H. S. Jackson
Sphacelotheca Sorghi (Link.) Clint.

Sorghum sp.
Sorosporium Reilianum (Kuhn) McAlp.
Sphacelotheca cruenta (Kuhn) Potter
Tolyposporium Volkensii P. Henn. (Appendix A.)

Sporobolus indicus R. Br.
Ustilago Schlechteri P. Henn.

Stenotaphrum glabrum (see St. secundatum (Walt.) Kunze

Stenotaphrum secundatum (Walt.) Kunze
Ustilago affinis Ell. and Ew.

Themeda Forskalii Hack. (see Th. triandra Forsk.)

Themeda triandra Forsk.
Sorosporium Holstii P. Henn.
Sphacelotheca Vryburgii Zundel

Trachypogon plumosus Nees
Ustilago Trachypogonis Zundel

Tristachya Rehmanni Hack.
Tolyposporium trystachydis (Syd.) Zundel

Triticum dicoccum Schrank
Urocystis Tritici Koern

Triticum durum Desf.
Urocystis Tritici Koern

Triticum turgidum Linn.
Urocystis Tritici Koern

Triticum vulgare Vill.
Tilletia foetans (B. & C.) Trel.

Tilletia Tritici (Bjerk.) Wint.
Urocystis Tritici Koern
Ustilago Tritici (Pers.) Rostr.

Urochloa helopus Stapf
Sorosporium verecundum (Syd.) Zundel
Sphacelotheca pretoriense (Pole-Evans) Zundel

Welwitschia mirabilis Hook.
Ustilago Welwitschiae Bres. (Appendix B.)

Zea Mays Linn.
Sorosporium Reilianum (Kuhn) McAlp.
Ustilago Zeae (Beckm.) Unger

Zinnia pauciflora Linn.
Entyloma Zinniae Syd.

INDEX OF GENERA, SPECIES AND SYNONYMS.

SOME SOUTH AFRICAN FUSARIA.

By E. M. Doidge.

The revised list of plant diseases known to occur in South Africa, which was published in 1931 (8), records a large number of *Fusarium* spp. found in diseased tissues, particularly in connection with wilts and foot rots. That little is known of the rôle of these organisms in plant disease in this country, is indicated by the fact that comparatively few South African records are to be found in the recent book "Die Fusarien," by Wollenweber and Reinking (61): therefore as a first step in the study of wilts and foot rots and the decay of storage organs, it was considered desirable, that as many strains as possible of the Fusaria associated with plant disease, should be studied and classified. The present account can only be regarded as a preliminary study of the genus *Fusarium* in South Africa; the work is far from complete, and records are lacking of a number of forms said by Wollenweber (61) to be prevalent in all warm countries; species of *Fusarium* are probably responsible for a number of wilt diseases which have not yet been investigated. A general survey of this kind, however, should be a useful basis for more detailed study, especially of the species causing vascular wilts of specific plants.

A large number of strains (± 100) was isolated while making a study of dry root rot of citrus trees, which is one of the most serious causes of loss in orange orchards. It was found that a large percentage of the fungi isolated from decaying citrus roots belonged to the genus *Fusarium*; these organisms were also found in roots apparently healthy and in the soil. Inoculation experiments have, so far, given only negative results, and it is not known what part the fungi play in the decay of the roots.

A further 300 strains were isolated while making a survey of the fungi found in citrus fruits decaying in storage. Apart from the citrus investigations, no systematic collections have been made. Many strains were isolated from plants sent for examination, or were obtained in the course of investigation of wilt diseases of tobacco, tomato, aster, cucurbits and other plants, by officers of the Division of Plant Industry. About 850 strains were studied in all, but a small percentage could not be brought into good sporulating condition and was discarded unidentified; these strains were chiefly Fusaria of the "*elegans*" section.

The method employed was as follows: Small portions of the affected tissues were planted in prune agar plates, and when sufficient growth had taken place, transfers were made to plain agar plates from which hyphal tip isolations were made (6), or single spore cultures were obtained by the dilution method. The culture media used for detailed observations and the methods adopted, were those recommended in "Fundamentals for taxonomic studies of Fusarium" (62); the synthetic medium adopted as a standard medium by Brown (7) with the addition of starch, was also used, as it proved a useful medium for the production of conidia; this medium was also largely used for stock cultures. In computing percentages of conidia with 0–3–5 or more septations, some 200 conidia were counted, and a large number were measured to get extreme and average measurements. (Measurements are given in microns unless otherwise stated.) Ridgways' colour standards and nomenclature (40) were used for recording the colours of conidia, mycelium and stroma of the various strains in culture on standard media. Representative conidia of each species, variety and form were drawn to scale with the aid of the camera lucida, the magnification being 1 : 800.

The general descriptions of species and varieties were adapted from those found in the monographs of Wollenweber and Reinking (59, 61), where full synonymy and bibliography may be found, the more detailed descriptions of conidia and cultural characters being derived from a study in culture of the South African strains isolated. Dried cultures of representative strains have been deposited for reference in the Cryptogamic section of the South African National Herbarium, these being indicated in the text by M.H. (mycological herbarium) numbers.

I am greatly indebted to Dr. Wollenweber for his advice and co-operation. He very kindly examined and identified some 50 strains in culture, and his annotations on the identifications were of great assistance, especially in the earlier part of the work. I am also indebted to him for perusing and criticising the manuscript.

I also wish to acknowledge the very considerable assistance of Mr. L. J. Kresfelder, who made a number of the original isolations, and was responsible for the major part of the laborious work of conidial computations and measurements. To Dr. V. A. Wager, I am indebted for a large number of cultures from wilting tomato and aster plants and from a number of other hosts. His isolations and collections are distinguished by his name in brackets after the record. I am also indebted to several other officers of the Division of Plant Industry for cultures and material.

FUSARIUM (Link).

Link H.F. in Mag. Ges. nat. Fr. 3 : 10, 1809 ; Spec. Plant. 2 : 105, 1825. Saccardo, Michelia 2 : 35, 1880 ; Syll. Fung. 4 : 694, 1886. Appel and Wollenweber in Arb. Biol. Anst. f. Land.-u. Forstw. Berlin.-Dahlem 8 : 60, 1910. Wollenweber and Reinking, Die Fusarien p. 9, 1935.

Syn. *Fusisporium* Link pr.p. in Mag. Ges. nat. Fr. 3 : 19, 1809 ; Spec. Plant. 1 : 30, 1824.
Fusidium Link pr. p. in Mag. Ges. nat. Fr. 3 : 10, 1809 ; Spec. Plant. 2 : 96, 1825.
Atractium Link pr. p. in Mag. Ges. nat. Fr. 3 : 10, 1809.
Fusoma Corda, Icon. Fung. 1 : 7, 1837.
Selenosporium Corda Icon. Fung. 1 : 7, 1837.
Pionnotes Fries, Summa. Veg. Scand. p. 481, 1849.
Microcera Desm. pr. p. in Ann. Sci. nat. 3, sér. 10 : 359, 1848.
Discofusarium Petch in Trans. Brit. Myc. Soc. 7 : 164, 1922.
Pseudomicrocera Petch in Trans. Brit. Muc. Soc. 7 : 164, 1922.
Discocolla Prill. et Del. in Bull. Soc. Myc. France 10 : 86, 1894.

Conidia scattered in the mycelium, in false heads forming large or small balls, in flat or raised mucilaginous layers (pionnotes), on a smooth or wrinkled thallus or direct on the substratum, or in masses on a tubercularia-like plectenchymatous to sclerotial stroma of limited extent (sporodochia) ; pale or brightly coloured (orange, salmon, ochre) in mass. Conidia often of two kinds ; microconidia which are usually 1-celled and scattered ; macroconidia which are usually 3- or more septate, fusiform to falcate, dorsiventral, curved in various ways or almost straight, and often with a pedicellate base.

Conidiophores simple to compoundly sub-verticillate ; conidia produced successively at the tips of the septate main conidiophore, or at the tips of its irregular or whorled lateral branches, sometimes united in chains. Occasionally they are formed (yeast-like) directly on the mother conidium or on short sterigma-like branches arising from it.

Chlamydospores usually present, globose, ovoid or pear-shaped, 1-2-celled or in chains or clusters, terminal or intercalary, brownish in colour or becoming tinged with the colour of the stroma.

Sclerotia spherical, solid, occurring singly, or in groups, or absent. Sclerotial stromata occur in many groups ; they are erumpent, hemispherical, smooth or rough and cauliflower-like ; or erect, stilboid, sometimes with antler-like branching, sessile or stalked ; they serve as a stroma for the sporodochia or remain sterile.

Hyphae septate, sparse or abundant, branched in various ways, epi- or endo-phytic free or forming a mycelium which may be loosely interwoven, or form a close, coremium-like to plectenchymatous or sclerotial mass. The mycelium is partly submerged and partly superficial, pale or brightly coloured (red, yellow, brown, green, blue). Aerial mycelium mould-like; mycelium in substratum gelatinous, leathery, plectenchymatous, often with patches of sclerotial thickening.

A number of species of *Fusarium* are the conidial forms of Ascomycetes of the genera *Nectria*, *Calonectria*, *Gibberella* and *Hypomyces*.

The genus has been divided by Wollenweber (61) into sixteen sections and sub-sections.

Key to the Sections and Sub-sections.

A.—Microconidia normally present, usually 1-celled, ovoid, fusoid, reniform or pyriform:—

- B.—Microconidia more or less pyriform .... *Sporotrichiella.*
- BB.—Microconidia not pyriform:
  - C. Chlamydospores wanting:
    - D. Microconidia in chains:
      - E.—Macroconidia thin-walled; colour and form of conidia and stromalike *Lateritium* .... *Liseola.*
      - EE.—Macroconidia comparatively thick-walled: colour, form of conidia, stroma and sclerotia like *Discolor* .... *Spicarioides.*
    - DD.—Microconidia not in chains in *F. neoceras*, and *F. moniliforme* v. *subglutinans* (*Liseola*), and *F. lateritium* vars. *minus* and *uncinatum* (*Lateritium*):
  - CC.—Terminal and intercalary chlamydospores present:
    - D.—Conidia with thin walls and delicate, rather inconspicuous septa, tapering or constricted towards the apex, pedicellate at the base, in mass brownish-white, pink, salmon-orange or sometimes quite pale *Elegans.*
    - DD.—Conidia with comparatively thick walls and distinct septations, sub-truncate, rounded or briefly rostrate, somewhat curved at the apex, more or less pedicellate at the base: in mass brownish-white, cream, golden yellow or often taking up the blue or green colour of the stroma .... *Martiella.*

AA.—Microconidia usually wanting, or 1-3- or more -septate, reniform, comma-shaped, fusoid or falcate:

- B.—Macroconidia apedicellate, usually apiculate:
  - C.—Pionnotes typically present. Comparatively slow-growing fungi, with thin-walled, indistinctly septate conidia:
    - D.—Stroma effuse, immersed, or matted and coremium-like, but not stilboid. Conidia subulate .... *Eupionnotes.*
    - DD.—Stroma cone-shaped to club-shaped, hard and horny when dry; or sessile, flat, loose, floccose. Conidia subulate, like those of the *Roseum* section:
      - E.—Entomogenous fungi (on scale insects)...... *Pseudomicrocera.*
      - EE.—Mycogenous fungi (on old Sphaeriaceae)...... *Submicrocera.*
  - CC.—Pionnotes scanty or wanting, seldom abundant. Comparatively quick-growing fungi .... *Arachnites.*

BB.—Macroconidia more or less pedicellate :

C.—Terminal chlamydospores absent :

D.—Intercalary chlamydospores wanting : conidia in sporodochia and pionnotes salmon or orange ; stroma effuse or erumpent, stilboid :

E.—Conidia thick-walled, sub-cylindrical, curved, abruptly constricted, curved and rostrate at the apex (as in *Martiella*). Comparatively slow-growing, entomogenous (on scale insects) and mycogenous fungi.................... *Macroconia.*

EE.—Conidia with thin walls and delicate, rather indistinct septa. Stroma often sclerotially erumpent, dark blue or pale :

F.—Macroconidia subcylindrical and equilaterally curved in the middle : abruptly constricted, recurved and rostrate at the apex. Mycelium white to pink. Stroma pale, sometimes violet, olivaceous, green. Form of conidia, colour, stroma and sclerotia like *Elegans*........................... *Lateritium.*

FF.—Macroconidia subcylindrical in the middle, curvature often somewhat inequilateral, long, subulate, falcate, tapering to both ends. Mycelium and stroma variable in colour, pink, purple, yellow or pale. Conidia mostly orange-red................ *Roseum.*

DD.—Intercalary chlamydospores present.

E.—Sporodochia usually wanting. Free conidia scattered in floccose mycelium, fusoid ; macroconidia either fusiform-lanceolate, tapering to both ends and not pedicellate ; or falcate and pedicellate. Colour pale, varying between *Gibbosum* and *Roseum*...................... *Arthrosporiella.*

EE.—Sporodochia present. Sclerotia dark blue, brownish-white or wanting.

F.—Macroconidia thin-walled, fusiform-falcate with parabolic or hyperbolic curvature, inequilateral ; apical cell prolonged, filiform to flagelliform ; base definitely pedicellate ; conidia in mass pale or pink to salmon ochre ; stroma brown, seldom carmine or yellow.................... *Gibbosum.*

CC.—Intercalary and sometimes terminal chlamydospores present :

FF.—Macroconidia with comparatively thick walls and septa, fusiform-falcate, tapering to both ends, inequilaterally curved ; apical cell sometimes constricted, almost rostrate, sometimes truncate or elongated; base pedicellate ; conidia in mass ochre, pink, salmon or orange. Stroma pale, pink, carmine, purple, yellow, brown, blue ; rarely pale and concolorous.

Sclerotia dark blue, brown, ochre or wanting. Mycelium white, pink or yellowish, sometimes flecked with blue.... *Discolor.*

CCC.—Terminal chlamydospores present, intercalary wanting. Stroma effuse, floccose to gelatinous; the long mycelial strands sometimes forming a coremium-like body, but not producing tubercularia-like sporodochia. Conidia scattered, in false heads, not forming extensive mucilaginous layers; wedge-shaped, with thick walls and septa, cream-colour to brownish-white............... *Ventricosum.*

Section **MACROCONIA** Wr.

Wollenweber, Fusarium-Monographie pp. 274–281, 1931. Wollenweber and Reinking, Die Fusarien pp. 27–28, 1935.

Conidia produced in salmon-orange pionnotes and sporodochia: comparatively large, rather thick-walled, mostly 3–5-9-septate, sub-cylindrical, abruptly constricted or curved and rostrate at the apex, more or less pedicellate at the base. In some species a few small, scattered, 1–2-celled conidia occur. Chlamydospores absent or scarce. Sclerotia present or absent. The formation of the stroma is variable and depends on climatic conditions and on the mode of life of the fungus. It may be limited in extent or effuse, smooth or wrinkled, or, when aerial mycelium is abundant, filamentous and loosely interwoven. Later it may be compact and assume various forms: occasionally also it may be delicate and evanescent or consist of hyphae penetrating the substratum, and then the conidia appear to be borne directly on the surface of the substratum.

Entomogenous and mycogenous species parasitic on scale insects and on other fungi, chiefly dark-coloured *Sphaeriaceae*. The entomogenous species, *Fusarium coccophilum*, is described by Wollenweber and Reinking (61) as the conidial form of *Nectria coccophila* (Tul.) Wr.

Fusarium coccophilum (Desm.) Wr. et Rkg.

Wollenweber and Reinking, Die Fusarien pp. 34–36, 1935. Wollenweber, Fus. aut. del. 344–348 351, 614, 861–868, 1124–1126.

Syn. *Microcera coccophila* Desm.; *Tubercularia coccophila* Bon.:
Microcera aurantiicola Petch; *M. coccidophthora* Petch;
Fusarium (Fusisporium) coccinellum (Kalch.) Thuem.;
Atractium flammeum Berk. et Rav.; *Stilbum flammeum* Tul.;
Fusarium baccharidicola P. Henn.; *F. callosporum* Pat.;
F. cataleptum Cke. et Harkn.; *F. nectriae-turraeae* P. Henn.;
Pionnotes pseudonectria Speg.; *Microcera pluriseptata* Cke. et Mass.

Stroma sometimes minute, evanescent, sometimes more or less plectenchymatous, hard when dry and becoming cartilaginous, or composed of loosely interwoven hyphae; occasionally wanting.

Conidia either abstricted from hyphae lying on the substratum, or forming an extensive pionnotal layer, or produced in sporodochia. The latter are composed of densely fasciculate conidiophores arising from a plectenchymatous base, or from a stilboid body composed of ascending hyphae united into a coremium. Sporodochia flattened-globose, conical, clavate or cylindrical, 0·5–2·5 × 0·25–0·6 mm., peach red to scarlet, fading to flesh ochre and rufous with age, surrounded at the base by a thin plectenchymatous sheath, which is continuous below and terminates above in irregular points. Conidiophores branching irregularly, seldom with opposite branches in pairs. (Plates 'II and IV.)

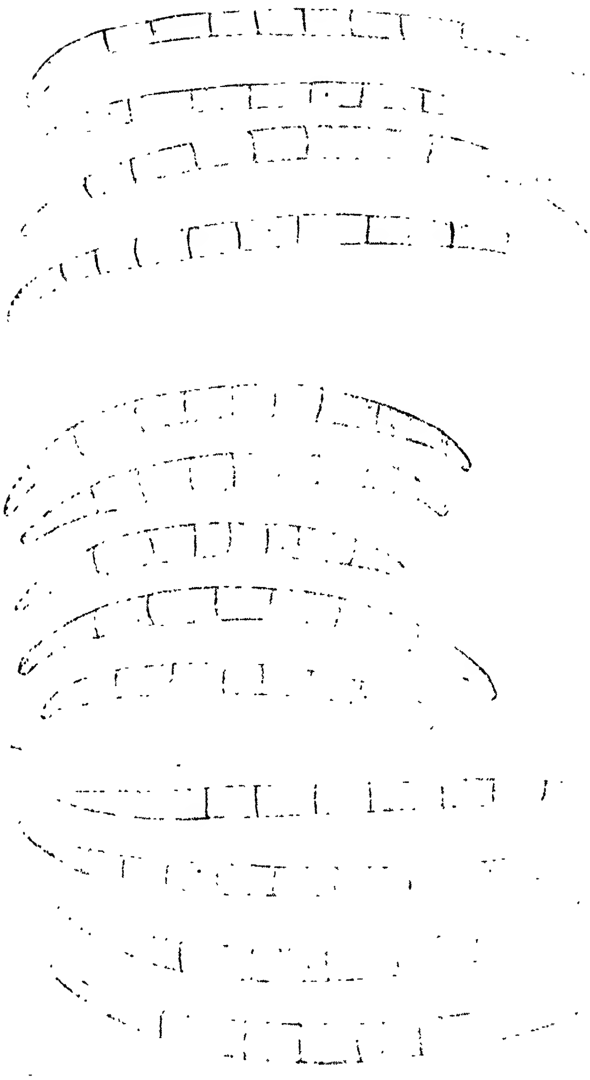

FIG. 1.
Fusarium coccophilum (Desm.) Wr. et Rkg.; macroconidia from (*a*) red scale on *Citrus* (M.H. 12174,) (*b*) pernicious scale on *Pyrus* (M.H. 21932), and (*c*) pionnotes of culture on oat agar, 14 days old.

Conidia thick-walled, sub-cylindrical to falcate, tapering to both ends; apical cell somewhat abruptly bent and constricted; base conical to subpedicellate. Conidia 5–7- or 7–9-septate, less frequently 3–4- and 10–12-septate; in mass salmon-orange to orange-scarlet; occasionally the cross walls are not easily perceptible.

3-septate....................	35–78 × 4–5.
5-septate....................	50–95 × 4·5–7.
7-septate....................	50–112 × 4·5–8.
9-septate....................	60–117·5 × 5–8.
11–12-septate................	98–142 × 5–8.

Chlamydospores and sclerotia lacking.

Fusarium coccophilum has been shown by Wollenweber and Reinking (61) to be the conidial stage of *Nectria coccophila*. The ascus form has not yet been observed in South Africa, although the conidial stage is extremely common. A description of *Nectria coccophila* follows :—

Nectria coccophila (Tul.) Wr. et Rkg.

Wollenweber and Reinking, Die Fusarien pp. 34–36, 1935. Wollenweber, Fus. aut. del. 679–682.
Syn. *Sphaerostilbe coccophila* Tul.

Nectria aurantiicola B. et Br. : *Sphaerostilbe aurantiicola* (B. et Br.) Petch.

Corallomyces aurantiicola (Berk. et Br.) Höhn.

Nectria coccidophthora Zimm. ; *Sphaerostilbe coccidophthora* (Zimm.) Petch.

Nectria coccidophthora Zimm. v. *aurantiicola* (Berk. et Br.) Rehm.

N. Balansae Speg. ; *N. congoensis* Syd.

N. laeticolor Berk. et Curt. ; *Sphaerostilbe flammea* Tyl.

N. Aglaothele Berk. et Curt. ; *N. colletiae* Rehm : *N. muscivora* Berk.

N. Passeriniana Cke. ; *Nectria coccicida* Speg. (in MS.).

N. subcoccinea Sacc. et Ell. ; *N. subfurfuracea* P. Henn. et E. Nym.

N. Turracae P. Henn.

Perithecia scattered or in groups, arising from a plectenchymatous or floccose stroma, 0·2–0·4 mm. diam. (average 0·28 × 0·25 mm.), orange red to dark red, darker at the ostiole, smooth or somewhat rough, almost spherical or conical, cupulate or laterally depressed. Ostiole papillate or not prominent. Asci cylindrical to club-shaped, with or without pedicel, 8-, seldom 4-spored, 70–130 × 6–10, usually monostichous. Paraphyses linear, delicate, evanescent. Spores oval to ellipsoid, at first hyaline, then yellowish pink : later thick-walled and finely verrucose, brown, 1-septate, 9–26 × 4–11, mostly 12–18 × 6–8 : the larger spores from 4-celled asci.

The *Fusarium* stage has been found on the following hosts in South Africa :

Hab. *Aspidiotus furcillae* Brain on bark of *Acacia horrida*, Somerset East, in silvis, 1876, leg. MacOwan (de Thuemen Myc. Universalis 782) M.H. 21956 : pr. pedem montium Boschberg, prope Somerset East, Nov., 1875, Fungi MacOwaniana 1059, M.H. 20913

Aspidiotus perniciosus Comst. (pernicious scale), on twigs of *Pyrus communis*, Chasedene, Maritzburg, Natal (van der Vyver), M.H. 21932.

Aspidiotus rapax Comst. (greedy scale) on twigs of *Ribes* sp., Haenertsburg, N. Transvaal, July 1911 (Doidge) M.H. 1684.

Chrysomphalus aurantii Mask. (red scale) on twigs and leaves of *Citrus* spp., Maritzburg, Natal, May, 1919 (Kelly) M.H. 12174 : without locality, April 1929, M.H. 25438 ; Duivelskloof, N. Transvaal, August 1911 (Doidge) M.H. 1845 ; Elim, N. Transvaal, January 1925 (Doidge) M.H. 20344 ; Bredasdorp, Cape (Turner) M.H. 20602 : Alkmaar E. Transvaal, June 1924 (Turner) M.H. 18191 : Richmond, Natal, March 1922. (Tedder) M.H. 15479 ; Mt. Silinda, S. Rhodesia, August 1931 (Lounsbury) M.H. 25973 : Maritzburg, May 1932 (van der Vyver) M.H. 26322 ; Politsi, N. Transvaal, Sept. 1934 (Wager) M.H. 27689 : Elim, April 1935 (Nyenhuis) M.H. 27561 ; Forest Hill, Tzaneen, Aug. 1932 (Turner) M.H. 26568.

Chrysomphalus aurantii Mask. (red scale) on twigs of *Rosa* sp., Ravenshill, N. Transvaal (Eland) M.H. 25932 ; Maritzburg, Nov. 1933 (Fouché) M.H. 27282.

Chionaspis sp., Victoria Falls, Rhodesia (Lounsbury) Aug. 1931, M.H. 25974.

Lepidosaphes Gloveri (mussel scale) on twigs of *Citrus* spp., Chase Valley, nr. Maritzburg, Feb. 1932 (van der Plank) ; Port St. Johns, Pondoland (Fraser) M.H. 26323.

Scale undet. on *Plectronia* sp., Cape Province, Oct. 1906 (Lounsbury) M.H. 193.

This species occurs on scale insects in tropical and subtropical regions in all parts of the world. The South African fungus was first collected by MacOwan in 1876 on *Aspidiotus furcillae* on *Acacia*, and was described as *Fusisporium coccinellum* Kalch., and then as *Fusarium coccinellum* (Kalch.) Thuemen in Fungi austro-africani, Flora 1876, p. 426 (Wollenweber Fus. aut. del. 344 and 861). It was also collected by Medley Wood (Wood No. 157)

on a scale insect on an unknown tree, Port Natal, and was identified as *Fusarium bacchari-dicola* P. Henn. (Wollenweber Fus. aut del. 865), which is now regarded as a synonym for *F. coccophilum.*

Fusarium coccophilum occurs on a number of different scale insects in the more humid, sub-tropical areas; it is very variable in the size and septation of the conidia. Fifteen collections were examined in detail; in seven of these 7–9-septate conidia predominated, in five (including MacOwan's collection) 5–7-septate conidia were most frequent, and in two of the collections most of the conidia were 3–5-septate. In culture there is an even wider range of size and septation than in conidia developing on the natural host.

For a full discussion of the nomenclature and synonymy of *Fusarium coccophilum*, see Wollenweber and Reinking (61) and Petch (33, 34).

Growth on Standard Media.

Oat agar: Growth slow, barely covering the surface of the slant in 7 days: growth in substratum colourless at first, but after 4 weeks tinged vinaceous russet, especially near base of slant. Pionnotes formed on older part of growth, and were well developed after 14 days; they were at first flesh colour, then salmon colour.

Hard potato agar: Growth slow; no aerial mycelium, growth in substratum colourless. Sporodochia formed in small groups, bitter-sweet-pink.

Standard synthetic agar plus starch: Growth slow, and mycelium almost covered with pionnotes which were well developed after 4 weeks; pionnotes at first salmon orange then bitter-sweet orange. After 8 weeks a group of sporodochia had developed at the base of the slant.

Potato agar plus 5 per cent. dextrose: Growth very slow, and conidia very freely produced. Pionnotes bitter-sweet orange to flame scarlet; mycelium fine, white, only visible as a ringe round the pionnotes.

Potato plug: Growth very slow, and consisting of a salmon-colour cushion-like stroma about 10 mm. diameter, with a very little fine, white mycelium in places on the surface. In four weeks the stroma became very much folded and wrinkled, and the colour faded to light pinkish cinnamon.

Melilotus stem: Growth very slow, forming a small cushion 5–10 mm. in diameter, bitter-sweet pink underneath, overlaid with a little fine, white mycelium.

Bean pod: Growth resembling that on potato, but less vigorous, and aerial mycelium very scanty.

Rice: Growth very slow, and penetrating very little into the medium; growth on substratum bitter-sweet pink. After 4 weeks the rice grains were covered with conidia.

Measurements of Conidia.

A.—From sporodochia on red scale and other scale insects; summary of measurements from 15 collections recorded above. Conidia in some collections chiefly 5–7-septate, and in others 7–9-septate: in two cases the majority were 3–5-septate.

11-septate..................	100 × 6.
10-septate..................	95–107·5 × 5–6·25.
9-septate..................	60–117·5 × 5–6·25.
8-septate..................	60–112·5 × 5–6·5.
7-septate..................	57–107·5 × 4·5–6·5.
6-septate..................	60–92·5 × 4–6.
5-septate..................	50–95 × 4·5–6.
4-septate..................	52·5–82·5 × 4·5–5.
3-septate..................	47·5–77·5 × 4·5–5·5.

B.—From sporodochia on pernicious scale (M.H. 21932): conidia in this collection were mostly 5–7-septate, more rarely 9-septate, a few 3-septate. Exact computations were not made.

9-septate	72·5–82·5 × 5–6·25.
7-septate	57·5–80 × 5–6·25.
5-septate	55–70 × 5–6.
3-septate	47·5–52·5 × 5–6.

C.—From culture derived from conidia of sporodochia on pernicious scale (M.H. 21932). Standard synthetic agar plus starch, culture 2 weeks old, conidia from pionnotes:—

11-septate	1 per cent	100–110 × 5–5·5.
10-septate	2 ,,	100–110 × 5–5·5.
9-septate	76 ,,	90–110 × 4·5–5·5.
8-septate	9 ,,	90–100 × 5–5·5.
7-septate	12 ,,	85–100 × 5–6.

Oat agar, culture 2 weeks old, conidia from pionnotes:—

12-septate	2 per cent	100–105 × 5.
11-septate	4 ,,	97·5–110 × 5.
10-septate	10 ,,	95–102·5 × 5–5·3.
9-septate	35 ,,	90–112·5 × 5.
8-septate	27 ,,	80–105 × 5.
7-septate	10 ,,	77·5–105·5 × 5–5·3.
6-septate	7 ,,	77·5–85 × 5.
5-septate	5 ,,	65–87·5 × 5.
4-septate	Rare	65 × 5.

Hard potato agar, culture 2 weeks old, conidia from pionnotes:—

11-septate	Rare	105 × 5·3.
10-septate	,,	115 × 5·3.
9-septate	5 per cent	92·5–105 × 5·3.
8-septate	18 ,,	82·5–102·5 × 5.
7-septate	37 ,,	75–100 × 5.
6-septate	22 ,,	75–80 × 5.
5-septate	18 ,,	50–85 × 5.
4-septate	Rare	60 × 5.

Section **SPICARIOIDES.**

Wollenweber, Sherbakoff, Reinking, Johann and Bailey, in Jour. Agric. Res. 30 : 841, 1925. Reinking and Wollenweber, Phil. Jour. Sci. 32 : 169, 1927. Wollenweber, Fusarium-Monographie 311, 1931. Wollenweber and Reinking, Die Fusarien, 36, 1935.

Microconidia delicate, ovoid, developing in chains and false heads, and later scattered in the mycelium. Macroconidia pluriseptate, thick-walled, cylindrical, moderately curved, constricted and rostrate at the apex; base pedicellate; borne in sporodochia and pionnotes, white to cream and ochre in mass. Stroma golden yellow to carmine red. Aerial mycelium white or tinged with the colour of the stroma. Sclerotia sometimes develope; they are convex, rugulose or stilboid. Chlamydo-spores absent.

Fusarium decemcellulare Brick.

Brick, C. Jahresber. Ver. f. Angew. Bot. 6 : 227 (1908). Wollenweber, Fusarium-Monographie 311, 1931; Fus. aut. del. 353, 869, 870. Wollenweber and Reinking, Die Fusarien, 36–38, 1935.

Syn. *Spicaria colorans* van-Hall-de Jonge.

Fusarium spicariae-colorantis (van Hall-de Jonge) Sacc. et Trott.

Fusarium theobromae Lutz (nec App. et Strk.).

FIG. 2.

Fusarium decemcellulare Brick; (*a*) macroconida from sporodochia of culture on Melilotus stem, 4 weeks old; (*b*) microconidia from mycelium on plain agar, 10 days old.

Microconidia ovoid, 1–2-celled, in chains or false heads, produced on more or less branched conidiophores in the aerial mycelium ; these form a powdery layer on the mycelium and are easily scattered. Macroconidia formed in sporodochia and pionnotes, which are at first white, then cream, brownish-white or ochraceous. Macroconidia large, cylindrical, somewhat curved especially near the ends, rostrate at the apex, pedicellate at the base, usually 5–9-, less frequently 3–4- or 10 12-septate.

0-septate..............	5–11 × 2–4·5, mostly.......	7–9 × 3–4.
1-septate..............	10–28 × 2–5, mostly........	12–20 × 4–4·5.
3-septate..............	20–67 × 3·5–6, mostly......	25–42 × 4·5–5·5.
5-septate..............	42–72 × 4·5–8, mostly......	53–64 × 4·7–6·5.
7-septate..............	60–95 × 4·5–8, mostly......	58–78 × 5–7·7.
9-septate..............	68–114 × 4·5–8·5, mostly...	75–97 × 5–8.
11-septate..............	73–131 × 5–9, mostly..	80–111 × 5·3–7·5.
12–13-septate..............	90–130 × 6–9, rare.	

Stroma yellow or carmine red, covered with white to pink, aerial mycelium. Plectenchyma sclerotially erumpent, and forming sclerotial growths which are convex, rugulose or stilboid. From these the ascus form developes later. Chlamydospores absent.

Hab. *Epichloë Zahlbrucknerianа* on *Sporobolus indicus*, associated with *Fusarium ciliatum* on the stroma, Acton Homes, nr. Bergville, Natal, March 1931 (L. A. Doidge).

Citrus sinensis Osbeck, from discoloured centre of Valencia orange from Zebediela, Transvaal, after 18 weeks in storage, 1934.

Fusarium decemcellulare is the conidial form of *Calonectria rigidiuscula*; the ascus stage has not yet been observed occurring naturally as a saprophyte in South Africa, but developed in cultures isolated from *Epichloë*, and sent to Dr. Wollenweber for identification. It may be characterised briefly as follows:-

Calonectria rigidiuscula (Berk. et Broome) Sacc.

Saccardo, Michelia 1: 313 (1878). Wollenweber, Fusarium-Monographie 312–314, 1931; Fus. aut. del. 800–802. Wollenweber and Reinking, Die Fusarien, 37–38, 1934. (For complete bibliography and synonymy see last-named publications.)

Perithecia scattered or in groups, ovoid to subconical, cream-coloured, yellow-brown when dry, 0·27 to 0·6 × 0·18–0·4 mm. (average 0·36 × 0·28 mm.); asci 4-spored, seldom 2- or 8-spored. Spores fusoid, slightly curved, obtrusely conical at both ends, obliquely striate, brownish-white in mass, mostly 3-septate, seldom (up to 14 per cent.) 4–6-septate, very rarely 1–2- or 7-septate.

1-septate..........	13–18 × 6–9.........	Average 15 × 7·2.
3-septate..........	18–37 × 5–9.........	Mostly 19 × 5·5–7·5, the larger spores in 2-spored asci (31 × 7) and the smaller in 8-spored asci (15–26 × 5·5–7·5).
5-septate..........	23–38 × 7–9.........	Average 28 × 7·6.
7-septate..........	25–45 × 7–9.	

Stroma rough or flat, pale, golden yellow or brown, sometimes evanescent. Mycelium at first floccose, white or pink, then drying up and disappearing.

Hab.- In culture derived from mycelial mat surrounding stroma of *Epichloe Zahlbrucknerianа* on *Sporobolus indicus*, cult. Wollenweber, M.H. 25897 B.

This species occurs on dry, decaying stems, fruits, etc., on various hosts (*Theobroma, Hibiscus, Melia, Anona, Ficus*) in tropical and sub-tropical regions of America, Asia and Africa.

Growth on Standard Media.

Oat agar: Mycelium at first woolly, short, white tinged rose pink, later becoming closely matted; it may then become spinel red and Indian lake in colour. Growth in substratum amaranth purple. After 3–4 weeks, dense masses of buff yellow pionnotes, or a few separate sporodochia may be produced.

Hard potato agar: In cultures studied, growth on this medium was not vigorous, and consisted of a little white, tufted aerial mycelium on a colourless substratum. A few sporodochia developed after 8 weeks. Reinking and Wollenweber (39) however, record a more vigorous growth with a rather thin, matted mycelium in cultures 12 days old; this was pomegranate purple, rose red and rose pink. Older cultures (45–90 days) had a more

matted mycelium with irregular, stromatic tufts, and the colour was pomegranate purple with a Bordeaux ring at the base. Sporodochia and pionnotes produced in large masses were warm buff and light orange yellow.

Standard synthetic agar plus starch: Aerial mycelium scanty; growth on substratum amaranth purple in the centre and olive ochre along the edges of the growth.

Potato agar plus 5 *per cent. dextrose:* Mycelium matted, pomegranate purple and olive ochre. Growth in substratum Bordeaux.

Potato plug: In cultures 14 days old, the plug was covered with tufted mycelium, which was white to rose colour. Spore masses were beginning to form. Groups of sporodochia, developing vigorously after 4 weeks, were light ochraceous buff; they often coalesced into large pionnotal masses. Individual sporodochia were sometimes columnar in shape.

Melilotus stem: After 14 days, stems were covered with a short, felt-like mycelium, which was white to tyrian pink, growth on the water at the base of the tube being amaranth purple. After 8 weeks, several groups of ochraceous buff sporodochia had developed.

Bean pod: Growth very similar to that on *Melilotus* stem, but spore masses produced less freely.

Rice: Growth Naples yellow to primuline yellow, in cultures 14 days old. In older cultures, the mycelium is more or less powdery, and yellow ochre to ochraceous orange in colour. Spore masses were sometimes produced.

Measurements of Conidia.

Potato plug, culture 4 weeks old, conidia from sporodochia :—

8-septate	Few	82·5 × 5.
7-septate	42 per cent	70–87·5 × 5–5·3.
6-septate	24 ,,	52·5–90 × 5–6·25.
5-septate	13 ,,	55–72·5 × 5–5·6.
4-septate	2 ,,	57·5 × 5.
0-septate	19 ,,	6–8 × 3–4·5.

Melilotus stem, culture 4 weeks old, conidia from sporodochia :—

9-septate	1 per cent	70–85 × 5·3.
8-septate	1 ,,	67·5–87·5 × 5–5·6.
7-septate	30 ,,	62·5–92·5 × 5–5·6.
6-septate	30 ,,	57·5–82·5 × 5–5·6.
5-septate	23 ,,	47·5–67·5 × 5–5·6.
4-septate	2 ,,	42·5–57·5 × 4·7–5.
3-septate	1 ,,	22·5–52·5 × 3·5–4·5.
0-septate	12 ,,	5–8 × 3·5–4·5.

Reinking and Wollenweber (39) give the following figures for the average measurements of conidia on several media :—

6-septate	17 per cent	56–73 × 5·5–7·25.
7-septate	27 ,,	60–83 × 5·5–7·25.
8-septate	12 ,,	59–86 × 6·25–7·25.
9-septate	14 ,,	75–90 × 6·25–6·75.

In the South African strains studied, there was a smaller percentage of conidia with 6–9 septations, and the majority were more slender.

Section **SUBMICROCERA.**

Wollenweber, Fusarium-Monographie, 281, 1931. Wollenweber and Reinking, Die Fusarien, 38, 1935.

Comparatively slow-growing fungi, chiefly mycogenous; they are found on dry branches and grasses, chiefly as parasites on other fungi (*Sphaeriaceales, Hypocreales*), or on the

thallus of lichens growing on trees. Conidia subulate, slender, thin-walled, pointed at both ends, never pedicillate, indistinctly septate. They occur in reddish, mucilaginous balls, on loose, cotton-wool-like mycelial tufts, or on a stilboid stroma. The latter may be 2 mm. high, and consists of hyphae which are loosely interwoven or coremium-like; the base is whitish and soft, and looks as if powdered with flour; often it is thickened bulbously above, and bears spherical balls of plectenchyma, on the surface of which are produced radiating conidiophores in dense clusters. These abstrict conidia in great numbers, and they collect in small drops or mucilaginous balls of an orange red colour. When dry, they form a continuous, adherent, resinous, brick red, crust. Chlamydospores wanting.

Only two species known, *Fusarium ciliatum* Lk., the type species, of which the ascus form is *Calonectria decora* (Wallr.) Sacc., and *F. cerasi* Roll. et Ferry with somewhat smaller, paler, more curved conidia. The latter species occurs in Europe and North America on dead branches of *Prunus cerasus*, *Ceraphora*, *Alnus* and *Corylus*.

Fusarium ciliatum Link.

Link, Spec. Plant. II: 105 (1825); Wollenweber and Reinking, Die Fusarien 38 39, 1935; Wollenweber, Fus. aut. del. 54, 437, 438, 872, 1128.

Syn. *Attractium ciliatum* Lk. pr. p.; *Microcera ciliata* (Lk.) Wr.
Fusarium ciliatum Lk. v. *majus* Wr.
Fusarium parasiticum West.; *F. peltigera* West.
F. scolecoides Sacc. et Ell.; *F. elongatum* Cke.
F. filisporum (Cke.) Sacc.; *Fusisporium filisporum* Cke.
Microcera massariae Sacc.

Conidia subulate, small, slender, delicate, straight or curved, tapering to both ends, apedicellate and more or less truncate at the base, in mass bittersweet pink to flame scarlet, fading to orange rufous and rufous when dry. Conidia 3-7- (mostly 5-7-) septate, seldom up to 10-septate or less than 3-septate; 5-septate 40-90 × 1·9-2·5-3, 7-septate 55-90 × 2·25-2·5. Conidia formed on floccose, loose, mycelial tufts, and adhering in mucilaginous balls, or borne on a coremium-like columnar, stilboid stroma. The conidiophores are simple or branched, and develope on the aerial mycelium, or in close clusters on the swollen, confluent, spherical balls of plectenchyma, which are produced on the top of the stalked stroma. Chlamydospores wanting.

Hab.—On the ascigerous stroma of *Epichloë Zahlbrucknerianа* on *Sporobolus indicus* and *Eragrostis plana*, Thornville Junction, Natal, March 1910 (Doidge) M.H. 865; Mooi River, Natal, March 1917 (Mogg) M.H. 10063; Cramond, Natal, April 1911 (Pole-Evans) M.H. 1369; Fairy Glen, Pretoria, March 1923 (Lounsbury) M.H. 17651; Acton Homes, Natal, February 1931 (L. A. Doidge) M.H. 25897; Hopevale, nr. Donnybrook, Natal (Morgan) M.H. 27749.

Fusarium ciliatum is found very commonly on the stroma of Epichloë, especially in Natal. The organism was identified by Dr. Wollenweber from a culture made from the specimen M.H. 25897. In nature, small patches of white, cottony to arachnoid mycelium appear on the surface of the stroma, rapidly becoming tinged with pink as the conidia develope. These patches consist of tangled hyphae which soon form at their tips a continuous, plectenchymatous layer, which in turn gives rise to very numerous, fasciculate conidiophores. The small patches of mycelium increase in size, coalesce, and often completely clothe the stroma of the host with a waxy or resinous, conidial layer. Occasionally the *Epichloë* stroma developes partially enveloped in the sheath of the grass leaf; in such a case, there is a layer of white mycelium between the stroma and the sheath, and the pionnotal layer developes on the edge of the sheath.

The fungus occurs in Europe and North America chiefly on *Massaria* and other fungi, on decaying branches of *Acer*, *Alnus*, *Ulmus*, *Fraxinus* and *Robinia*. It is also found on lichens (*Peltigera*) (see Wollenweber, Fus. aut. del. 54, 437, 438, 872).

FIG. 3.

Fusarium ciliatum Link.; Macroconidia from (*a*) the conidial mat on the stroma of *Epichloë*, and (*b*) sporodochia of 8 weeks old culture on oat agar.

F. ciliatum is the conidial form of *Calonectria decora* (Wallr.) Sacc. the ascus stage has not yet been observed in South Africa. It may be briefly described as follows:—

Calonectria decora (Wallr.) Sacc.

Saccardo, Michelia 1 : 310, 1872; Syll. Fung. II : 543. Wollenweber and Reinking, Die Fusarien, 39, 1935. Wollenweber, Fus. aut. del. 54.

Syn. *Sphaeria decora* Wallr.; *Nectria decora* (Wallr.) Fuck.
Nectria Massariae Pass. in herb.; *Calonectria Massariae* (Pass.) Sacc.
Calonectria Dearnessii Ell. et Ev.; *C. diminuta* (Berk.) Berl. et Vogl.
Nectria diploa Berk. et Curt. v. *diminuta* Berk.
Creonectria diploa Seav. non Berk. et Curt.
Calonectria agnina (Rob.) Sacc.; *C. pyrrochlora* Sacc.

Perithecia covered with whitish or rosy-white hyphal threads, ovoid, 0·2 0·27 × 0·15 0·24 mm. (average 0·24 × 0·2), fleshy, light orange to wax yellow, later becoming paler, with a darker, definitely orange-red papilla, 70 μ broad, leaving free an ostiole formed of radiating hyphae. Asci club-shaped, 70–96 × 12 18, 8-spored, sessile. Spores more or less distichous, hyaline, narrow-ellipsoid, tapering somewhat to both ends, straight or slightly curved, at first smooth, then minutely verrucose, 1 3-septate, 16 35 × 5–8, (av. 23 × 5·5). Paraphyses filiform.

Conidia and hosts as described above for *Fusarium ciliatum*.

Growth on Standard Media.

Oat agar: Aerial mycelium fairly abundant, white, cottony, tufted. After 14 days, there was a tinge of congo pink in the plectenchymatous layer on the substratum, and conidial masses were beginning to appear. Conidial masses developed very slowly, elevated on mycelial tufts, at first bittersweet pink, then grenadine; they were up to 2 mm. diameter.

Hard potato agar: Growth rather slow, but otherwise similar to that on oat agar.

Potato agar plus 5 per cent. dextrose: Aerial mycelium flesh pink, cottony or mealy after 14 days. Growth in substratum becoming wrinkled and felt-like and tinged buff pink.

Potato plug: Growth advanced slowly and was not vigorous. Mycelium cottony, white, tinged vinaceous pink.

Melilotus stem: Growth slow, mycelium white, cottony.

Bean pod: After 7 days, about one-third of the pod was covered with white, cottony mycelium, and pods were entirely covered in 4 weeks.

Rice: Growth was more vigorous than on the last three media mentioned; mycelium at first white or tinged with pink, and after 14 days pale flesh colour to flesh colour.

Measurements of conidia.

From pionnotes on stroma of Epichloë, conidia mostly 5–7-septate.

5-septate.......... 40–62·5 × 2 2·5.
7-septate.......... 55–75 × 2·25 2·5.

Oat agar, culture 4 weeks old, conidia from sporodochia.

Conidia most 7-septate.

7-septate.......... 45–72·5 × 2–2·5.
6-septate.......... 66–75 × 2 3. Only occasionally up to 3 μ thick.
5-septate.......... 55 61·25 × 2–3. Only occasionally up to 3 μ thick.
4-septate.......... 45–52·5 × 2.
3-septate.......... 20–40 × 2–2·5.

In the European specimens, conidia are mostly 5-septate, 50 90 × 2·25 2·75.

Section SPOROTRICHIELLA.

Wollenweber, H. W., apud Lewis in Maine Agr. Exp. Sta. Bull. 219: 256, 1913. Sherbakoff, N.Y; (Cornell) Agr. Exp. Sta. Memoir 6: 183, 1915. Wollenweber and Reinking, Phytopath. 15: 156, 1925. Die Fusarien, 45–46, 1935; Reinking and Wollenweber, Phil. Jour. Sci. 32: 115, 1927.

Microconidia 1–2-celled, spherical-ovoid, lemon or pear-shaped and also fusoid-ellipsoid. In the species *Fusarium poae* and *F. chlamydosporum*, only a few falcate macroconidia are found scattered in the mycelium: in the other species they are more or less abundant and are produced in sporodochia and pionnotes. Chlamydospores usually abundant. In this respect the section differs from the *Roseum*-Fusaria, which have no chlamydospores, but somewhat similar macroconidia. It resembles the *Roseum* section in the colour of the stroma,

which is typically carmine to purple red or ochre yellow. From the section *Arthrosporiella* it differs in the occurrence of spherical microconidia and of sporodochial and pionnotal conidial masses.

Fusarium chlamydosporum Wr. et Rkg.

Wollenweber and Reinking, Phytopath. 15 : 156, 1925 ; Die Fusarien, 47–48, 1935. Wollenweber, Fus. aut. del. 883. Reinking and Wollenweber, Phil. Jour. Sci. 32 : 115–116, 1927.

Conidia-bearing mycelium floccose, pale or pink ; growth on substratum plectenchymatous, sometimes forming somewhat verrucose, tubercular, sclerotial bodies ; of various colours, pale, carmine to purple-red, sulphur-yellow, ochre to dark brown. The dark colour is due to the development in the mycelium of numerous chlamydospores ; these are spherical to pear-shaped, smooth, rough or spiny, intercalary or terminal, single, in pairs, in chains or in clusters, 10–16 μ in diameter.

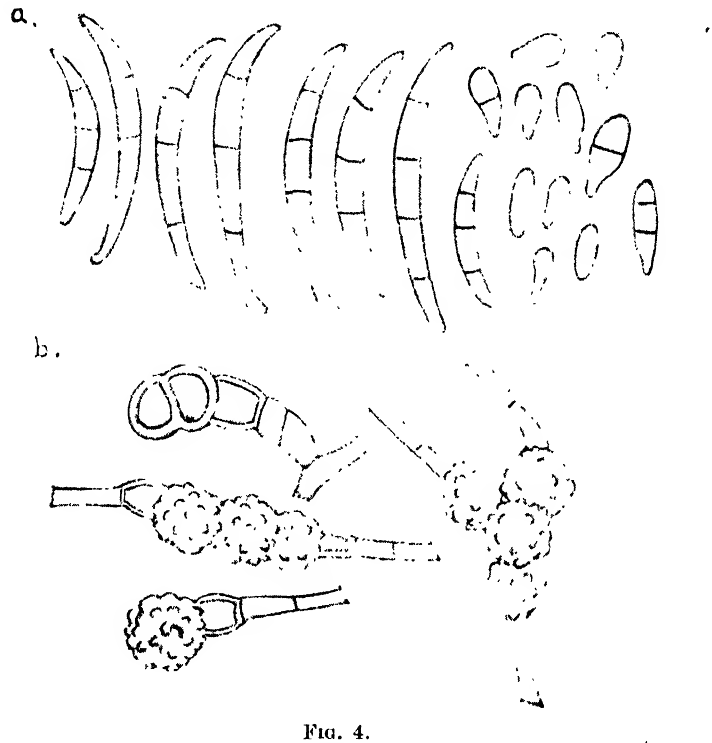

FIG. 4.

Fusarium chlamydosporum Wr. et Rkg. ; (*a*) conidia from mycelium on synthetic agar plus starch, culture 10 weeks old ; (*b*) chlamydospores from culture on plain agar, 6 weeks old.

Microconidia small, fusoid-ellipsoid, not spherical or lemon-shaped, usually 1-celled, seldom septate ; macroconidia scattered, rare, 3-septate, falcate, subpedicellate.

0-septate……………………	4–11 × 2·5–4 (av. 7 × 3·25).
1-septate……………………	11–16 × 3·4 (av. 13 × 3·5).
3-septate……………………	27–32 × 3·5–4 (av. 29 × 4).

Hab.—*Brachiaria pubifolia* Stapf, on ovaries, Nelspruit, E. Transvaal (Liebenburg).

This species has also been observed on dead locusts, *Nomadacris septemfasciata*, in South West Africa (61) ; it was first described from banana stems, and from soil and air in Central America (39).

Growth on Standard Media.

Oat agar: Aerial mycelium fairly abundant, cottony, becoming matted and felt-like, tinged in places with sea-shell pink and a little yellow ochre; sometimes becoming brownish when chlamydospores are abundant. Growth in substratum carmine, with a patch of ochre to buckthorn brown at the top of the slant, where the medium was dry.

Hard potato agar: Aerial mycelium white, cottony; growth in substratum colourless. Reinking and Wollenweber (39) record the development of a cameo pink and spinel red mycelium on this medium.

Standard synthetic agar plus starch: Aerial mycelium moderate, cottony, white, becoming tinged cinnamon buff to clay colour with age. Growth in substratum spinel red to dahlia carmine.

Potato agar plus 5 per cent. dextrose: Aerial mycelium fairly dense, cottony or matted and felt-like, white or tinged with the colour of the stroma. Growth in substratum carmine to ox-blood red, with patches of ochre.

Potato plug: Plugs covered with a cottony mycelium, which was white to buffy brown; there were tinges of carmine or pomegranate purple in the substratum.

Melilotus stems: Growth copious, tomentose, white to buffy brown and buckthorn brown.

Rice: Mycelial growth dense, felt-like on the surface of the medium, at first white and rose pink above, and yellow ochre round the rice grains below. After some weeks, the growth was snuff brown to bistre.

Measurements of Conidia.

Standard synthetic agar plus starch, culture 10 weeks old, conidia from mycelium.

0-septate..............................	5–15 × 2·5–4·5.
1-septate..............................	10–20 × 4·5.
2-septate..............................	12·5–22·5 × 3·75–4·5.
3-septate..............................	20–35 × 3·5–4·5.
4-septate..............................	24–47·5 × 4·5.
5-septate..............................	50 × 4·75.

Chlamydospores very abundant, single, in pairs, or in chains and clusters; at first smooth and colourless, becoming golden brown and verrucose when mature, 9–14 μ in diameter.

Section ROSEUM.

Wollenweber, Phytopath. 3 : 32, 1913. Reinking and Wollenweber, Phil. Jour. Sci. 32 : 148, 1927 Wollenweber and Reinking, Die Fusarien, 49–53, 1935.

Macroconidia subulate, slender, thin-walled, only weakly refractive, curved to almost straight, typically of even diameter for a considerable part of their length, tapering gradually to both ends, pedicellate at the base, orange colour or lighter in mass, brick red or reddish brown when dry. Macroconidia borne on the aerial mycelium, on the stroma, or in pionnotes and sporodochia direct on the substratum. When the aerial mycelium is well developed, they may also be scattered in the mycelium or in false heads. Stroma yellow, ochre, carmine red or reddish brown. Aerial mycelium white, pink or yellowish. Blue sclerotial stromata occur occasionally in some species and not at all in others. Chlamydospores wanting. Ascus stage unknown.

Fusarium avenaceum (Fr.) Sacc.

Sacc. Syll. Fung. 4 : 713, 1886. Wollenweber and Reinking, Die Fusarien 53–55, 1935. Wollenweber, Fus. aut. del. 127, 128, 130–136, 139–164, 178–194, 560–568, 572–574, 892, 894–899, 1132, 1133.

Syn. *Fusisporium avenaceum* Fr. ; *Sarcopodium avenaceum* Fr.

Fusarium biforme Sherb. ; *F. effusum* Sherb.

Fusarium herbarum (Cda.) Fr. plus *f. 1* and *f. 2*.Wr., *v. avenaceum* (Fr.) Wr.

v. gibberelloides Wr., *v. graminum* (Cda.) Wr. pr. p.

v. pirinum (Fr.) Wr., *v. tubercularioides* (Cda.) Wr.

v. viticola (Theum.) Wr.

F. heterosporum Nees f. *paspali* Ell. et Ev. ; *F. lucidum* Sherb.

F. metachroum App. et Wr., plus *v. minus* Sherb. ; *F. paspali* P. Henn.

F. sorghi P. Henn. ; *F. subulatum* App. et Wr., plus *v. brevius* Sherb.

F. truncatum Sherb. ; *F. zeae* (West.) Sacc.

For complete synonymy, see Wollenweber and Reinking, loc. cit.

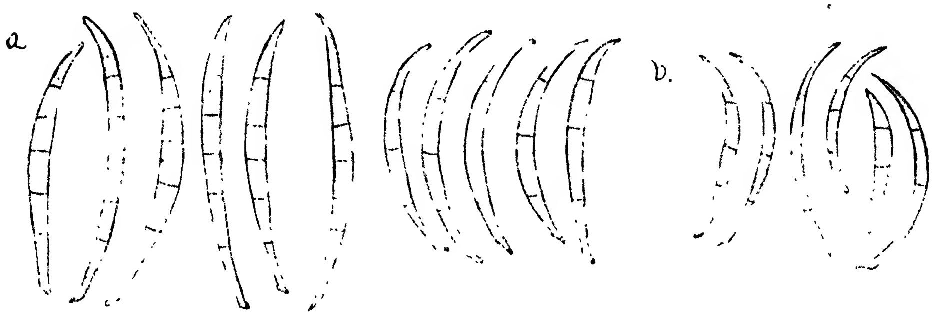

FIG. 5.

Fusarium avenaceum (Fr.) Sacc. ; Conidia from pionnotes of 6 weeks old cultures on (*a*) synthetic agar plus starch and (*b*) oat agar.

Conidia seldom scattered, usually in false heads or balls, or in sporodochia and pionnotes ; the latter are orange or cinnabar-red to scarlet, becoming darker if drying in a resinous mass, or becoming lighter and pink if drying in a powdery condition ; conidial masses may also become tinged with the colour of the stroma. Stroma yellow, ochre, carmine to red brown ; aerial mycelium white, or tinged with the colour of the stroma. True sclerotia, or sclerotially erumpent, rugulose stromata rarely found. Sclerotia, when present, single or in groups, 60–80 μ diam., dark blue or pale. Conidia mostly 3–5-septate, long, subulate or filiform, symmetrically arcuate to elliptically curved, or somewhat more curved near the apex than in the middle ; base more or less pedicellate :—

3-septate............	22–61 $\times$ 2·3–6,	........mostly 30–48 $\times$ 2·7–3·9.
5-septate............	35 80 $\times$ 2·5–6,	........mostly 45–66 $\times$ 3·1–4·4.
7-septate............	61–74 $\times$ 3·4–5,	........mostly 64 $\times$ 4·1.
0-septate............	6 17 $\times$ 2·5–4,	........average 11 $\times$ 2·9.
1-septate............	10–25 $\times$ 2·4–4,	........average 18 $\times$ 3.

Conidiophores simple, or with irregular to fasciculate branching ; branches are irregular or in whorls of 2–4 or rarely 5.

Hab.—*Eleusine indica* Gaertn. (goose grass), from stems of plant dying from attack of *Helminthosporium* sp., Acton Homes, Natal, Jan. 1931 (L A. Doidge).

Puccinia ranulipes Doidge on *Asparagus laricinus*. Poplars near Wonderboom, Pretoria dist., 1937 (in teleutosori).

F. Avenaceum is very widely distributed in the temperate zone, and occurs on a wide range of host plants. It occurs on 150 different genera, including grasses, cereals, crop plants, etc., also on other fungi, e.g., *Meliola, Claviceps, Uredineae.*

Growth on Standard Media.

Oat agar: Aerial mycelium not abundant in cultures made from conidia, copious if grown from a mycelial transfer, fine, floccose, white or tinged with pink. Growth on substratum at first colourless, in four weeks becoming carmine to ox-blood red. Sporodochia apricot-buff to salmon orange, fading to ochraceous orange and cinnamon rufous with age.

Hard potato agar: Like oat agar, but growth in substratum colourless, and sporodochia smaller and less freely produced.

Standard synthetic agar plus starch: Aerial mycelium scanty, white tinged with pink. growth in substratum yellowish, then carmine to pomegranate purple. Pionnotes formed chiefly along the needle track, at first pale flesh colour, then apricot buff to apricot orange.

Potato agar plus 5 per cent. dextrose: Aerial mycelium abundant, tomentose, at first white, then rose pink. Growth in substratum geranium pink to carmine. No spore masses were seen.

Potato plug: Plug covered with abundant white mycelium, becoming matted and felt-like, and tinged with pink where it touched the glass; stroma carmine. A few large sporodochia developed; they were apricot buff.

Melilotus stem and bean pod: Growth slow and sparse. Aerial mycelium tomentose, not abundant, white to ochre. No spore masses were observed.

Rice: Mycelium at first white; aerial mycelium later tinged with pink; growth on substratum at first flesh pink, then carrot red; rice grains cream to naples yellow, later becoming wood brown.

Measurements of Conidia.

Oat agar, culture 6 weeks old, conidia from sporodochia:—

5-septate............	42 per cent........	35–51 × 3·5–4·5.
4-septate............	16 ,, ...	29–41 × 3–4.
3-septate............	37 ,, ...	23–36 × 3–4.
0–2-septate..........	5 ,,	

Standard synthetic agar plus starch, culture 4 weeks old, conidia from pionnotes:—

6-septate............	Few................	52 × 4.
5-septate............	61 per cent........	40–52·5 × 3·75–4·5.
4-septate............	10 ,, ...	32–40 × 3·5–4.
3-septate............	29 ,, ...	25–40 × 2·75–4.
0–2-septate..........	Few.	

The conidia in the only strain studied were smaller than the average for the species. See measurements given in the general description.

Fusarium avenaceum (Fr.) Sacc. **f. 1.** Wr. et Rkg.

Wollenweber and Reinking, Die Fusarien, 55, 1935. Wollenweber, Fus. aut. del. 174–176, 571, 890 1134.

Syn. *Fusarium arcuatum* Berk. et Curt.; *F. arcuatum* Berk. et Curt. *v. majus* Wr.

F. anthophilum Wr. (non A. Braun).

F. Schiedermayeri (Thuem.)Sacc.; *Fusisporium Schiedermayeri* Thuem.

This form differs from the species in the colour of the stroma, which is pale, white to flesh colour or yellowish. Conidia in sporodochia and pionnotes orange, 3–5-septate, less frequently 0–1-, or 6–7-septate.

3-septate............	22–48 × 2·5–3.......	Mostly 23–46 × 2·5–4.
5-septate............	24–88 × 2·8–5·5.....	Mostly 40–67 × 2·8–5.
7-septate............	46–91 × 3·5–5·5.......	Average 65 × 4·2.
9-septate............	65–102 × 3–5.	
0-septate............	8–14 × 1·5–4·7......	Average 10·5 × 3.
1-septate............	12–22 × 2·6.........	Average 17 × 3.

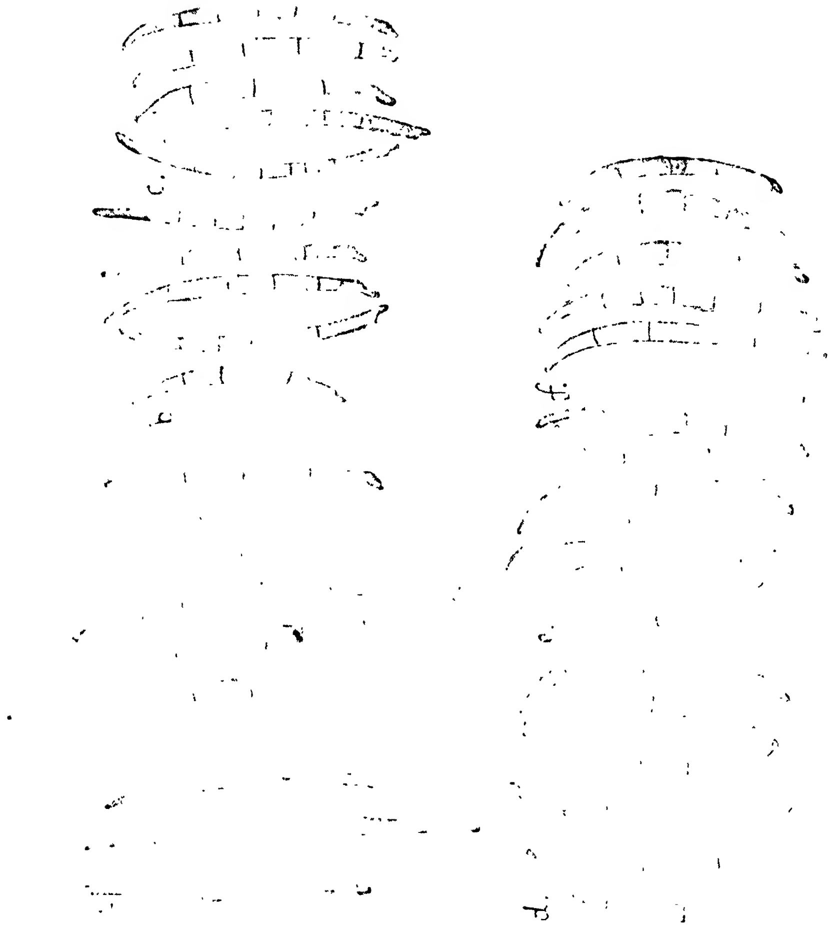

FIG. 6.

Fusarium avenaceum (Fr.) Sacc. *f.1.* et Rkg.; (*a*) conidia from pionnotes on ovaries of *Paspalum* conidia from (*b*) small sporodochium of 4 weeks old culture on standard synthetic agar plus starch; (*c*) small sporodochium of 4 weeks old rice culture; conidia from pionnotes of 2 weeks old culture on (*d*) bean pod (*e*) potato plug and (*f*) Melilotus stem; b-c, culture from *Paspalum*; d-f, culture from *Citrus*.

Hab. *Citrus* sp., from bark of tree, orange on lemon stock, shewing collar rot, Godwan River Estates, E. Transvaal, October 1930 (Marloth).

Euphorbia crassipes Marloth, from decaying stems, Willeston, Cape, M.H. 28379.

Paspalum dilatatum Pair, on ovaries infected with *Claviceps paspali*, Cedara, Natal, January 1930 (Gill), M.H. 25473; Eshowe, Zululand, January 1930 (van der Plank) M.H. 25864.

Paspalum distichum L., on ovaries infected with *Claviceps paspali*, Eastern Vlei, Durban, April 1926 (Kent) M.H. 21105; Umbilo, nr. Durban, April 1926 (Kent) M.H. 23699.

F. avenaceum f. 1. occurs on a number of hosts, usually in the temperate zone, and is less widely distributed than the type species. It is known as a cause of rotting in apples.

Growth on Standard Media.

Oat agar: Aerial mycelium cottony, often tufted, scanty in cultures from conidia, abundant from a mycelial transfer, white, becoming tilleul buff to pale pinkish buff. Growth

in substratum buff pink. Pionnotes and sporodochia, developing freely after 14 days, were buff pink to salmon colour or apricot buff to apricot orange. After 2 months, sporodochia up to 3 mm. in diameter were frequently present in large numbers at the base of the slant; they frequently coalesced to form more extensive conidial layers. In one set of cultures, a tinge of deep delft blue developed in the stroma at the base of the slant after 8 weeks.

Hard potato agar: Aerial mycelium scant to moderate, white, cottony, covering the medium, or developing only near the top of the slants. Sporodochia fairly well developed after 4 weeks, apricot buff to apricot orange, remaining discrete, or coalescing to form a pionnotal layer.

Standard synthetic agar plus starch: Aerial mycelium scant or moderate in amount, cottony, tufted, white, sometimes tinged with barium yellow. Pionnotes well developed after 5 weeks, at first sea-shell pink, then salmon buff. In one set of cultures, there was a patch of blue-black plectenchyma at the base of the slant.

Potato agar plus 5 *per cent. dextrose:* Aerial mycelium copious, cottony to arachnoid, white to flesh colour and primrose yellow. Growth in substratum pale to flesh colour becoming apricot buff to olive brown with age. The pink colour fades from the aerial mycelium after 12–14 weeks, and it is then white to citron yellow. Groups of sporodochia sometimes developed, they were apricot orange to bittersweet orange.

Potato plug: Plug covered with a moderate to vigorous mycelial growth; this was white to primrose yellow and flesh pink, but the pink colour faded after 14 days, and the mycelium was then white and citron yellow. After 4 weeks the aerial mycelium became rather flattened and felt-like. Growth on substratum pale to flesh colour or naphthalene yellow. Pionnotes developed freely in 14 days and were flesh ochre. In one set of cultures, a few specks of blue-black plectenchyma developed at the back of the plug against the glass.

Melilotus stem: Aerial mycelium scanty to moderate or copious, white, sometimes tinged primrose yellow, cottony to sericeo-tomentose. Pionnotes developed freely after 14 days, flesh ochre. A few blue-black sclerotia developed in one strain.

Bean pod: Mycelial growth moderate to vigorous, short or sericeo-tomentose, white, then primrose yellow in places; pionnotes developing after 14 days, flesh pink; sporodochia forming occasionally, apricot buff.

Rice: Mycelial growth at first white; growth on substratum becoming pale flesh colour to flesh colour; grains becoming naples yellow and then barium yellow. Sporodochia sometimes formed in groups after 14 days; they were numerous, 0·5 to 1 mm. in diameter, or coalescing to form spore masses up to 5 mm. in diam., carrot red to grenadine in colour.

Measurements of Conidia.

A.—Direct from the pionnotal layer on the host, *Claviceps Paspali.*

M.H. 25473.—

5-septate	Few	37–50 × 3·5–4.
4-septate	2 per cent	40–45 × 3–3·7.
3-septate	75 ,,	22·5–42·5 × 2·75–3.
2-septate	6·5 ,,	
1-septate	7 ,,	
0-septate	9·5 ,,	

M.H. 21105.—

7-septate	0·5 per cent	57·5 × 3.
6-septate	0·5 ,,	50–60 × 3·7.
5-septate	7 ,,	37·5–52·5 × 3–5.
4-septate	9·5 ,,	32·5–42·5 × 3–4.
3-septate	78·5 ,,	25–45 × 2·5–3.
2-septate	1·5 ,,	
1-septate	2·5 ,,	

M.H. 23699.—

9-10-septate	Rare	80-85 × 4·7-5.
8-septate	Rare	70-72·5 × 4-4·5.
7-septate	0·5 per cent	60-75 × 3-4·5.
6-septate	0·5 ,,	55-70 × 3-4.
5-septate	11·8 ,,	45-52·5 × 3-4·5.
4-septate	16·8 ,,	37-50 × 2·5-3.
3-septate	69·6 ,,	30-47·5 × 2·5-3.
1-septate	0·4 ,,	
0-septate	0·4 ,,	

In the last list of measurements, there is an unusually large percentage of conidia with 4-10 septations, and the higher septate conidia are longer than the average.

B.—Measurements of conidia from cultures (strain isolated from M.H. 25473).

Oat agar, culture 4 weeks old, conidia from sporodochia—

5-septate	3 per cent	40-55 × 3-3·75.
4-septate	19 ,,	37·5-52·5 × 2·8-3·75.
3-septate	77·5 ,,	30-52·5 × 2·8-3·75.
1-septate	0·5 ,,	

Standard synthetic agar plus starch, culture 4 weeks old, conidia from sporodochia—

4-septate	4 per cent	42·5-47·5 × 2·8-3·75.
3-septate	96 ,,	35-47·5 × 2·5-3·75.

Rice, culture 4 weeks old, conidia from sporodochia—

5-septate	2 per cent	45-50 × 2·8-3.
4-septate	24 ,,	45-50 × 2·5-3.
3-septate	72·6 ,,	30-47·5 × 2·5-3.
1-septate	0·7 ,,	
0-septate	0·7 ,,	

Potato agar plus 5 per cent. dextrose, culture 4 weeks old, conidia from sporodochia—

4-septate	1·5 per cent	35-37·5 × 2·5-3.
3-septate	88·5 ,,	21·25-37·5 × 2·5-3.
2-septate	1 ,,	
1-septate	8 ,,	
0-septate	1 ,,	

C.—Measurements of conidia from culture derived from citrus.

Oat agar, culture 4 weeks old, conidia from pionnotes—

5-septate	10 per cent	32-50 × 3·5-4.
4-septate	28 ,,	30-45 × 3-4.
3-septate	62 ,,	22·5-37·5 × 2·5-3·75.

Bean pod, culture 14 days old, conidia from pionnotes—

6-septate	Few	52·5 × 4·7.
5-septate	74 per cent	37·5-55 × 3·75-4·5.
4-septate	17 ,,	35-45 × 3-3·75.
3-septate	6 ,,	22·5-37·5 × 2·5-3·75.
0-2-septate	3 ,,	

Melilotus stem, culture 14 days old, conidia from pionnotes—

5-septate	8 per cent	42·5-50 × 3·25-3·75.
4-septate	17 ,,	34-47·5 × 3·25-3·75.
3-septate	70 ,,	22·5-45 × 2·5-3·75.
0-2-septate	5 ,,	

Hard potato agar, culture 14 days old, conidia from pionnotes—

6-septate	1 per cent	50-60 × 3·5-4.
5-septate	26 ,,	40-50 × 3·75-4.
4-septate	24 ,,	40-45 × 3·75-4.
3-septate	42 ,,	25-42·5 × 2·75-4.
0-2-septate	7 ,,	

Section ARTHROSPORIELLA.

Sherbakoff, New York (Cornell) Agric. Exp. Sta. Memoir 6 : 161, 1915. Wollenweber, Ann. Myc. 15 : 2, 1917 ; Ber. deutsch. bot Ges. 35 : 733, 1918 ; Fusarium-Monographie 324, 1931. Wollenweber and Reinking, Phytopathology, 15 : 157, 1925 ; Die Fusarien, 57, 1935. Reinking and Wollenweber, Phil. Jour. Sci. 32 : 118, 1927.

Aerial mycelium abundant, floccose. Stroma more or less effuse, variable in colour ; it may be light, yellowish, pink or ochre, to light or chestnut brown. Sporodochia typically absent, and pionnotes also usually absent. Conidia usually scattered in the aerial mycelium, of two kinds : Small to medium in size, with 0–3 septations, fusiform, cuneate or lanceolate, apedicellate ; or larger, 3- or more septate, fusiform-falcate, with basal cell conical, constricted or papillate (rarely pedicellate). Chlamydospores intercalary, seldom terminal. Spherical sclerotia occasionally developing, and usually pale or light brown in colour.

Fusarium semitectum Berk. et Rav. var. **majus** Wr.

Wollenweber, Fusarium-Monographie, 325, 1931 ; Fus. aut. del. 113–116, 552, 907–910. Wollenweber and Reinking, Die Fusarien, 59, 1935.

Syn. *Fusarium asparagi* Briard ; *F. incarnatum* (Rob.) Sacc.
Fusisporium incarnatum Rob. ; *Fusarium juglandinum* Peck.
Fusarium oxysporum Schl. subsp. *aurantiacum* Sacc. (non Corda).
F. oxysporum Schl. *v. aurantiacum* f. *hyalina* Brun.
F. pallido-roseum (Cke.) Sacc. ; *Fusisporium pallido-roseum* Cke.
Fusarium roseum Lk. v. *calystegiae* Sacc.

Aerial mycelium white to flesh-colour or isabellinous ; stroma plectenchymatous, light brown or pink. Chlamydospores intercalary. Sporodochia wanting. Conidia powdery, scattered in the aerial mycelium, or adherent in clusters or false heads, salmon pink in mass ; 5-septate, or less frequently 3–4-, occasionally 6–10-septate, intermingled with smaller, 0–2-septate forms. Macroconidia fusiform to lanceolate, straight or slightly curved, usually conical at the base, sometimes papillate, exceptionally pedicellate.

0-septate............	5–15 × 2–4.........	Mostly 6–12 × 2·2–3·2.
1-septate............	9–24 × 2·5–4........	Mostly 14–21 × 2·5–3·2.
3-septate............	13–40 × 2·5–4·8.....	Mostly 19–29 × 3–4·5.
5-septate............	29–52 × 2·5–6.......	Mostly 30–48 × 3·7–4·8.
7-septate............	45–70 × 3·7–6·2.....	Mostly 44–61 × 4·3–6.
9-septate............	50–70 × 4–6.........	Average 60 × 5·3.

Hab. *Citrus Limonia* Osbeck, from collapsed fruit from Sunday's River, Cape, after seven weeks in storage.

Citrus sinensis Osbeck, in decaying fruits ; from stem end and navel end rot of oranges, after 12–18 weeks in storage (7 isolations) ; in navel oranges from White River, E. Transvaal, Zebediela and Letaba, N. Transvaal, and from Sunday's River, Cape.

On twigs dying back ; Hankey, Cape (van der Plank) ; Ofcalaco, N. Transvaal (van der Plank), July 1930, M.H. 28400.

Dianthus caryophyllus L., from stems of wilting plants, Durban (McClean).

Striga lutea Lour., from stems of dying plants, Ixopo, Natal (Mack).

Glossina sp., from dead Tsetse fly, Zululand, 1931 (Harris) M.H. 28446.

Musa Sapientum L., from surface of fruit, Acornhoek (Boyce).

Nomadacris septemfasciata, on red locusts dying from the attack of *Beauvaria* sp., Pretoria dist., 1933.

Eggs, from purplish-brown, discoloured patches of membrane, which at this point adhered to the shell, albumen partially coagulated (ass. *F. moniliforme*), sent by Poultry Inspector, Port Elizabeth (Bottomley).

This species is a common saprophyte on old, dry parts of plants, and on decaying fruit, in all parts of the world.

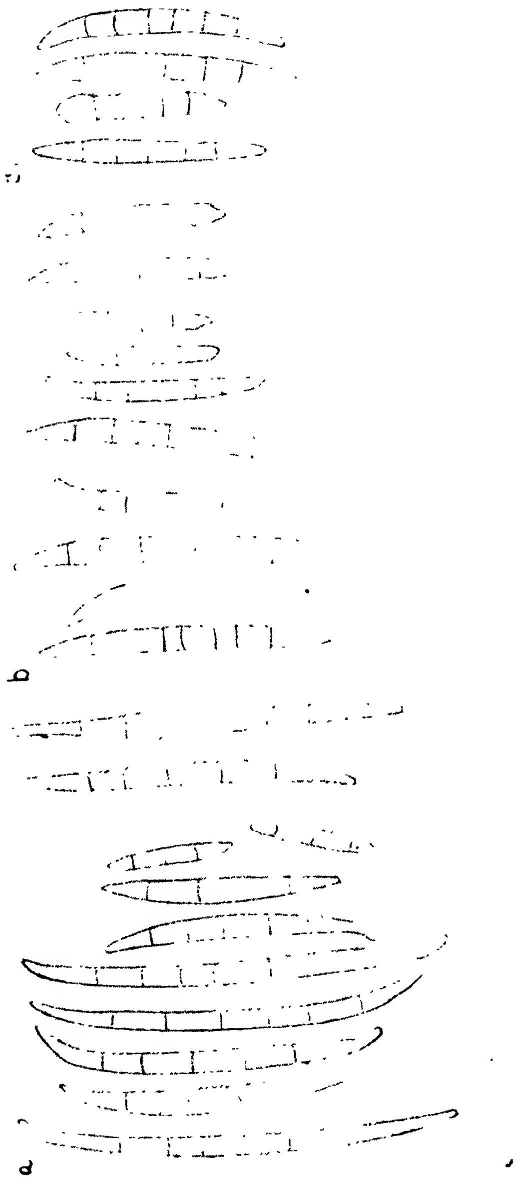

Fig. 7.

Fusarium semitectum Berk. et Rav. v. *majus* Wr.; conidia from mycelium of 2 weeks old culture on (*a*) synthetic agar plus starch (*b*) oat agar and (*c*) bean pod.

Growth on Standard Media.

Oat agar: Aerial mycelium rather scant, white, cottony, becoming mealy-looking after 14 days, owing to the production of clusters of conidia in the mycelium. Growth on substratum light pinkish cinnamon, sometimes with a line of sepia at the base of the slant.

Hard potato agar: Aerial mycelium short, white, becoming mealy-looking, longer and cottony near the top of the slant. Growth flesh pink when conidia are freely produced.

Standard synthetic agar plus starch: Aerial mycelium scant, white, cottony; growth in substratum white to light pinkish cinnamon.

Potato agar plus 5 per cent. dextrose: Aerial mycelium copious, fine, cottony; at first white, after 7 days tinged naples yellow and pale salmon colour; later it may become pale to dark olive buff or brownish olive, the darker colour at the base of the slant. Growth in substratum at first salmon colour to flesh ochre, later it may become citrine drab to brownish olive. Aerial mycelium often mealy in appearance, owing to the formation of conidia.

Potato plug: Plug covered with a copious growth of white, cottony myceiium; later it becomes felt-like and wrinkled, or mealy-looking if conidia are present. Growth in substratum flesh colour to flesh ochre, sometimes becoming deep olive or buff to buffy brown with age. When conidia are produced freely in the aerial mycelium, they are pale pinkish cinnamon in mass.

Melilotus stem: Aerial mycelium moderate in amount, white to dirty-white, or tinged ochre, tomentose or sericeo-tomentose.

Bean pod: Aerial mycelium vigorous, tomentose to mealy, white, or tinged salmon colour and pinkish buff owing to the presence of numerous conidia.

Rice: Growth at first white to flesh pink, and rice grains naples yellow. Growth may remain pink or become wood brown to natal brown, with the grains also brown. Powdery spore masses are white to pale pinkish cinnamon.

Measurements of Conidia.

Bean, culture 4 weeks old, conidia from mycelium—

8-septate	Few	75 × 4.
7-septate	Few	55–75 × 3–4.
6-septate	Few	45 × 4.
5-septate	39 per cent.	25–62·5 × 3–5.
4-septate	7 ,,	25–35 × 3·5–4.
3-septate	30 ,,	20–32·5 × 2·5–4.
2-septate	1·5 ,,	15–20 × 3–4.
1-septate	18 ,,	8–20 × 2–4.
0-septate	4·5 ,,	7·5–10 × 2–4.

Hard potato agar, culture 4 weeks old, conidia from mycelium—

7-septate	1 per cent.	62·5–70 × 3·2.
6-septate	2 ,,	55–62·5 × 3–4.
5-septate	52 ,,	35–60 × 3–4.
4-septate	3 ,,	30–40 × 3–4.
3-septate	37·5 ,,	20–50 × 3–3·75.
0–2-septate	4·5 ,,	

Standard synthetic agar plus strach, culture 4 weeks old, conidia from mycelium—

8-septate	Rare	55 × 3·4.
7-septate	1 per cent.	65–80 × 3·75–4.
6-septate	6 ,,	57·5–72·5 × 3–3·75.
5-septate	20 ,,	30–55 × 3–4·7.
4-septate	7·5 ,,	30–45 × 2·8–3·7.
3-septate	60 ,,	25–30 × 3–5.
0–2-septate	5·5 ,,	

A few intercalary chlamydospores were observed on plain agar plates.

Section GIBBOSUM.

Wollenweber, Fusarium-Monographie 328, 1931. Wollenweber and Reinking, Die Fusarien 61–62, 1935.

Aerial mycelium white or brownish, less frequently yellow, pink or carmine. Stroma ochre to blackish brown, sometimes golden yellow to carmine red; plectenchymatous stroma may, or may not be rugulose and sclerotially erumpent; spherical, brown or dark blue sclerotia present or absent. Microconidia scattered more or less freely in the young mycelium, disappearing later. Macroconidia in sporodochia and pionnotes, also found in false heads and clusters, or in a loose powder on the mycelium; in mucilaginous masses, the conidia are isabellinous to ochre and orange red; when dry and powdery, they are light-coloured, brownish white. Typical conidia thin-walled, but distinctly 3-5-7- or more septate, dorsiventral, slender, more or less falcate, with parabolic or hyperbolic curvature, sometimes with rather acutely arched dorsal line and somewhat less curved ventral line, tapering at both ends, with filiform or flagelliform apical cell, and very definitely pedicellate base. Chlamydospores intercalary, seldom terminal, in conidia and mycelium, spherical, single, in chains or in clusters, brown in mass. The ascus stage is *Gibberella*.

Key to South African Species.

A.—Curvature of macroconidia more or less parabolic or falcate.
- B.—Macroconidia 3 (3–5) septate: 3-sept. 33 × 4: 5-sept. 46 × 4·6 .... *F. equiseti.*
- BB.—Macroconidia 3-5-sept.: 3-sept. 33 × 3·75: 5-sept. 42 × 4·3 .... *F. equiseti* v. *bullatum.*

AA.—Curvature of macroconidia more or less hyperbolic. Conidia 5-septate.
- B.—5-septate conidia 43 × 4·4, comparatively compact, 8-9 times as long as broad .... *F. scirpi* v. *compactum.*
- BB.—5-septate conidia comparatively slender, 10-12 times as long as broad.
  - C.—Stroma not carmine to yellow .... *F. scirpi.*
  - CC.—Stroma carmine to yellow .... *F. scirpi* v. *acuminatum*
- BBB.—5-septate conidia very long and slender, 14–21 times as long as broad .... *F. scirpi v. filiferum.*

Fusarium equiseti (Cda.) Sacc.

Saccardo, Syll. Fung. 4: 707, 1886. Wollenweber, Fusarium-Monographie, 330, 1931; Fus. aut. del. 202–208, 210, 211, 596, 597, 919, 920. Wollenweber and Reinking, Die Fusarien, 63–65, 1935.

Syn. *Fusarium equiseti* (Cda.) Sacc. *f. 1.* Wr.; *Selenosporium equiseti* Cda.
Fusarium Cordae Mass.; *F. falcatum* App. et. Wr.
F. falcatum App. et Wr. v. *fuscum* Sherb.
F. mucronatum Fautr. in herb. pr. p.; *Fusoma pallidum* Bon.
Fusarium ossicolum (Berk. et Curt.) Sacc.; *Fusisporium ossicola* Sacc.

Conidia sparse at first, scattered in the mycelium, which is white to yellowish, or pink; they are 1-celled or septate, oval or oblong to fusiform-falcate, sometimes comma-shaped, and they disappear when the typical macroconidia begin to develop. Stroma pale or brown, not carmine red, and of varying extent. Macroconidia in tubercular sporodochia, in pionnotes or in clusters, seldom powdery and scattered in the mycelium; in mass they are at first pale, almost mealy white, then ochre to salmon pink; when dry, the spore masses are honey colour to cinnamon brown or lighter. Macroconidia typically fusiform, thick in the centre and tapering gradually to each end, curvature parabolic, straight or bent at the apex and tapering to a fine point, pedicellate at the base; dorsal side usually more strongly

curved than the ventral side; cells more or less equal, cross walls seldom more closely crowded in the centre than at the ends; mostly 5-septate, seldom 3-4-, exceptionally up to 12-septate.

0-septate............	7-18 × 2·5-6........	Average 12 × 2·5.
1-septate............	12–24 × 2-4.........	Average 16 × 3.
3-septate............	12–44 × 2·3-5·5.....	Mostly 15–36 × 2·5-4·8.
5-septate............	26–74 × 2·8-5·7.....	Mostly 29-56 × 3-5·3.
7-septate............	42–80 × 4-6.........	Mostly 52–62 × 4·2-5·3.
8–12-septate.........	Up to 83 × 5·5.	

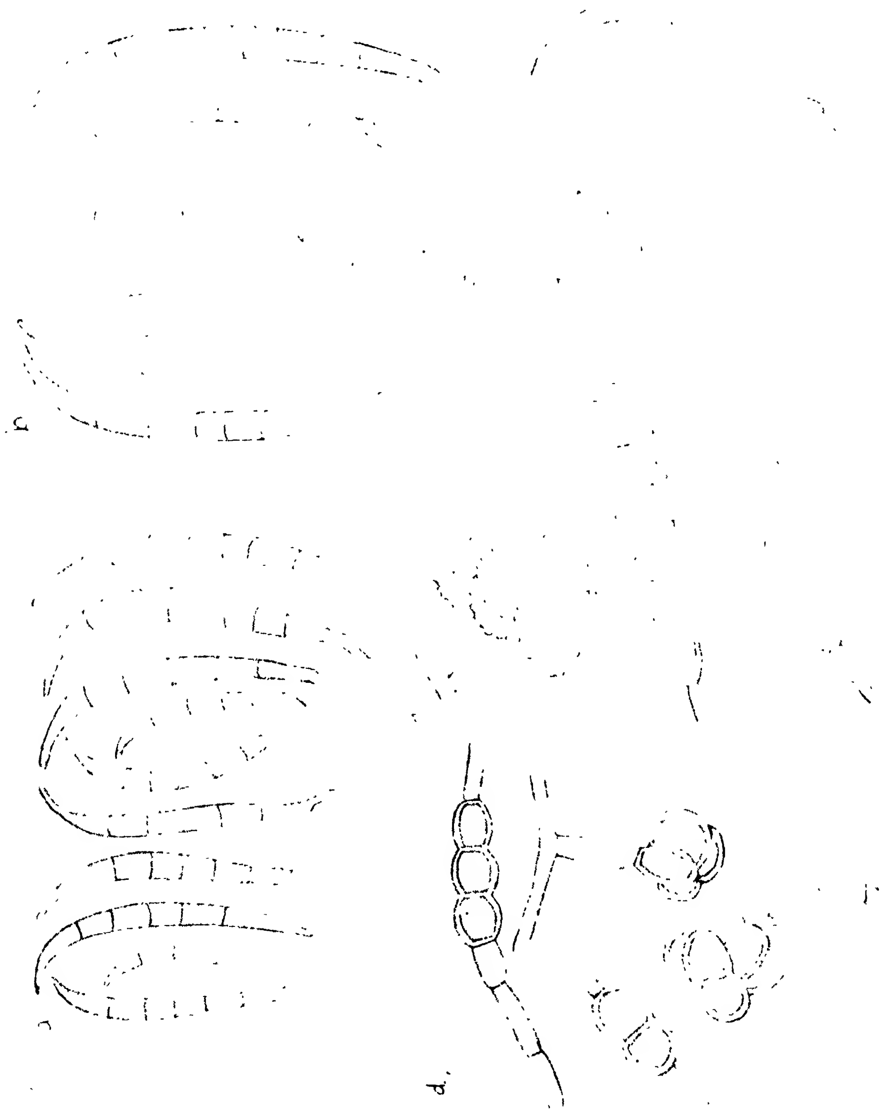

Fig. 8.

Fusarium equiseti (Cda.) Sacc.; conidia from (*a*) mycelium of culture on plain agar, 5 days old; (*b*) pionnotes of 2 weeks old culture on synthetic agar plus starch; (*c*) sporodochia of 8 weeks old culture on oat agar; chlamydospores from (*d*) culture on plain agar, 5 days old, and (*e*) culture on hard potato agar, 4 weeks old.

Conidiophores simple or branched; branches spreading or fasciculate, arranged in successive whorls of 2–3 or more, and bearing at their tips groups of 1, 2 or 3 sterigma-like pegs to each ultimate branch. Chlamydospores 6–14 μ in diameter, round, smooth or rough, more frequently intercalary than terminal, sometimes 1-celled, but usually in chains or clusters; brown in mass.
Hab. *Citrus sinensis* Osbeck, from Valencia oranges shewing stem end rot after 12–18 weeks in storage; oranges from Zebediela, N. Transvaal, 1933.
Cucumis sativus L., from stems of wilting plant, Uitenhage, Jan. 1935 (Haines).
Lycopersicum esculentum Mill., from tomato seed offered for sale, Pretoria, 1931 (Wager); from petioles of dying plants, Gqaga, Transkei (Wager).
Striga lutea Lour., from stems of dying witchweed plants, Ixopo, Natal (Mack.).

Growth on Standard Media.

Oat agar: Aerial mycelium abundant, cottony, white to pale pinkish buff and pinkish buff; growth on substratum congo pink. A few small salmon-buff sporodochia developed in two months.

Hard potato agar: Aerial mycelium sparse to moderate in amount, cottony to arachnoid, white; growth in substratum colourless.

Standard synthetic agar plus starch: Aerial mycelium sparse, white, in scattered tufts. Pionnotes began to appear after 8 days, and were well developed after 15 days; they were light vinaceous cinnamon.

Potato agar plus 5 *per cent. dextrose:* Aerial mycelium fairly abundant, cottony, white to pale flesh colour; aerial mycelium and growth in substratum became brown with age.

Potato plug: The plug became covered with a dense, matted, cottony mycelium, which was at first white to seashell pink; the pink colour soon faded. Growth on substratum isabella colour to light brownish olive. A few salmon buff sporodochia developed after 21 days.

Melilotus stem: Aerial mycelium fairly copious, white. A few flesh ochre sporodochia developed on some twigs, and on others a fairly extensive pionnotes.

Bean pod: Aerial mycelium abundant, cottony to arachnoid; at first white to shell pink, soon becoming ochraceous buff and clay colour. No conidial masses seen.

Rice: Mycelium tilleul buff to vinaceous buff, with a ring of buffy brown at the base of the growth.

Measurements of Conidia.

Standard synthetic agar plus starch, culture 15 days old, conidia from pionnotes—

10-septate	0·3 per cent	82 × 5.
9-septate	1 ,,	72·5–75 × 4·5–5.
8-septate	2 ,,	65–75 × 4·5–5.
7-septate	16·3 ,,	52·5–75 × 4–5.
6-septate	12·3 ,,	50–62·5 × 4–5.
5-septate	58·4 ,,	35–57·5 × 3·75–5.
4-septate	7·3 ,,	30–40 × 3·75–4·5.
3-septate	2·4 ,,	22·5–27·5 × 3·75–4.

Potato, culture 9 weeks old, conidia from sporodochia—

7-septate	2 per cent	40–52·5 × 3·75–5·8.
6-septate	3·5 ,,	37·5–50 × 3·75–5.
5-septate	66 ,,	26·25–57·5 × 3·75–5·8.
4-septate	6·5 ,,	22·5–40 × 3·5–5·8.
3-septate	14·5 ,,	15–32·5 × 3·75–5.
2-septate	4·5 ,,	20–27·5 × 3·5–4.
1-septate	3 ,,	10–30 × 3·5–4.

Fusarium equiseti (Cda.) Sacc. var. **bullatum** (Sherb.) Wr.

Wollenweber, Fusarium-Monographie, 331, 1931; Fus. aut. del. 117. 290, 913–918. Wollenweber and Reinking, Die Fusarien, 64–65, 1935.

Syn. *Fusarium bullatum* Sherb.

F. bullatum v. *roseum* Sherb. and v. *roseo-bullatum* (Sh.) Wr.

F. bullatum Sherb. v. *brevius* Wr. et Rkg., and v. *minus* Wr. et Rkg.

F. equiseti (Cda.) Sacc. v. *bullatum f. 1.* et *f. 2.* Wr.

F. nectriae-palmicolae P. Henn.; *F. terrestris* Manns.

The conidia of this variety are, on the whole, somewhat less curved than those of the type species, and of other members of the *Gibbosum*-section; the foot at the base of the conidium is less sharply defined. The septation is inclined to be lower than in the typical *F. equiseti*, and in the mycelial stage, there are often produced lanceolate forms, recalling the conidia of the *Arthrosporiella-Fusaria*, or forms resembling the sub-normal conidia of the *Discolor*-Fusaria. Typical conidia from sporodochia and pionnotes measure—

5-septate............ 31–47 × 4–4·9....... Average 42 × 4·3.

3-septate............ 30–36 × 3·7–3·8..... Average 33 × 3·75.

They are cream to salmon colour in mass. Chlamydospores are mostly intercalary, in chains, or in small or large clusters. Aerial mycelium is usually abundant, of average height and density, and almost pure white in colour. The stroma is pale to brown, and the substratum often absorbs the colour of the stroma.

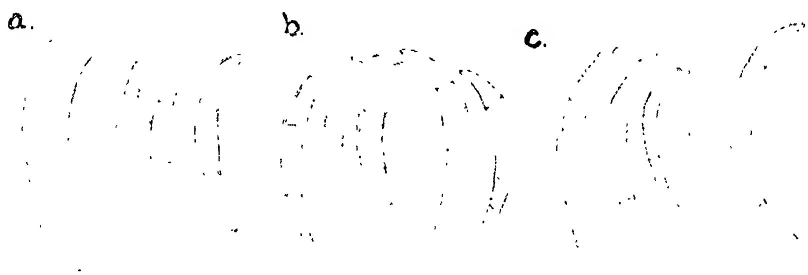

FIG. 9.

Fusarium equiseti (Cda.) Sacc. v. *bullatum* (Sherb.) Wr.; conidia from sporodochia of 4 weeks old cultures on (*a*) standard synthetic agar plus starch, (*b*) oat agar, and (*c*) Melilotus stem.

Hab. *Mesembrianthemum* sp., from rotting stems of succulent plants, Pretoria (Wager).

This variety occurs on decaying parts of plants belonging to a number of different genera, in tropical and sub-tropical countries. It is known in Asia and America, and occurs occasionally on scale insects.

The ascus stage is *Gibberella intricans* Wr., which is said to develop freely in pure cultures. It has not been observed in South Africa, either occurring naturally or in pure culture. It may be briefly characterised as follows:—

Gibberella intricans Wr.

Wollenweber, Fusarium-Monographie 332, 1931; Fus. aut. del. 810. Wollenweber and Reinking, Die Fusarien, 65–66, 1935.

Perithecia solitary or in groups, ovoid, rugulose, ostiolate, 0·17–0·4 × 0·15–0·3 mm. usually 0·3–0·35 × 0·18–0·24 mm., blue-black; asci spuriously paraphysate, clavate, 8- or 4-spored, rarely 2-spored, monostichous or obliquely distichous; sporidia 3-septate, rarely 1–2- or 4–7-septate, fusoid, more rarely straight than curved, slightly falcate, conical at both ends; 3-septate sporidia 19–36 × 3·7–7, mostly 21–33 × 4·1–5·6.

The *Gibberella*-stage was first observed on dry leaves of banana (39).

Growth on Standard Media.

Oat agar: Mycelium white, tomentose, fairly abundant; growth in substratum colourless. Pionnotes, forming freely after 14 days, were light ochraceous salmon.

Hard potato agar and standard synthetic agar plus starch: Growth on these media resembled that on oat agar.

Potato Agar plus 5 per cent. dextrose: Aerial mycelium white, tomentose; Growth on substratum at first white to cream colour, becoming salmon colour, and, after 4 weeks, pale pinkish cinnamon to dark olive buff.

Potato plug: After 14 days, the plug was covered with a vigorous growth of white, tomentose mycelium.

Melilotus stem: After 14 days, the stems were covered with a white, tomentose to sericeo-tomentose mycelium; pionnotes, pinkish buff in colour, developed after 4 weeks.

Bean pod: Growth similar to that on *Melilotus* stems.

Rice: After 14 days, the growth was white to tilleul buff: after 4 weeks, the colour deepened to wood brown in places.

Only one strain of this variety was studied, and in this, the colour of the stroma was somewhat lighter than that of strains studied elsewhere (39).

Measurements of Conidia.

Oat agar, culture 4 weeks old, conidia from pionnotes –

5-septate............	27 per cent........	25-40 × 3-3·75.
4-septate............	56·5 ,, ...	22·5-37·5 × 3-3·75.
3-septate............	16·5 ,, ...	17·5-25 × 3-3·75.

Standard synthetic agar plus starch, culture 4 weeks old, conidia from pionnotes—

5-septate............	36 per cent..........	31-47·5 × 3-4·5.
4-septate............	50 ,, ...	30-35 × 3-3·75.
3-septate............	14 ,, ...	22·5-30 × 3-3·75.

Melilotus stem, culture 4 weeks old, conidia from pionnotes—

5-septate............	23 per cent..........	30-37·5 × 3-4.
4-septate............	50 ,, ...	25-35 × 3-3·75.
3-septate............	25·5 ,, ...	20-30 × 3-3·5.
1-septate............	1·5 ,,	

Fusarium scirpi Lamb. et Fautr.

Lambotte et Fautrey, Rev. Mycol., 111, 1894. Wollenweber, Fusarium-Monographie, 334-335, 1931; Fus. aut. del. 198–201, 212–218, 595, 598, 926–929, 1137. Wollenweber and Reinking, Die Fusarien, 66, 1935.

Syn. *Fusarium scirpi* Lamb. et Fautr. *f. 1.* Wr.; *F. sclerotium* Wr.
F. scirpi Lamb. et Fautr. v. *nigrantum* (*-nigrans*) Benn.
F. scirpi Lamb. et Fautr. v. *pallens* Benn., and v. *comma* Wr.
F. gibbosum App. et Wr.; *F. aleyrodis* Petch.
Fusarium sclerodermatis Oud. v. *lycoperdonis* Pich.
F. chenopodinum (Thuem.) Sacc.; *Fusisporium chenopodinum* Thuem.
Fusoma helminthosporii Corda.
Fusarium roseum Lk. f. *solani nigri* Sacc. in Myc. Ven. 367.

Sporodochia pale, yellowish pink or ochre to salmon colour; at first they are minute bodies the size of a pin's head, and soon become dry and powdery, or, if moist, coalesce into an extended pionnotes. Spore masses, when dry, are pale to light brown, or occasionally cinnamon brown. Aerial mycelium loose, cottony or filamentous, light or brownish, later disappearing. Stroma brown, rarely with blue-black spherical sclerotia. Conidia resemble those of *F. equiseti*, but the apical cell is more prolonged and pointed, and the curvature of the dorsal side is strongly hyperbolic; the cross-walls are more numerous, and are more

closely crowded in the middle of the conidium than at the ends. Scattered microconidia are at first comparatively abundant, 0-3-septate, oval, fusiform, reniform or comma-shaped, and also club-shaped to lanceolate. Macroconidia produced in sporodochia and pionnotes typically falcate, mostly 5-septate, more rarely 3-4- or 8-11-septate.

0-septate............	5-12 × 2-4..........	Mostly 6-10 × 2·4-3·5.
1-septate............	8-20 × 2-4..........	Mostly 10-15 × 2·7-3·5.
3-septate............	10-55 × 2·5-7·3.....	Mostly 17-44 × 3·3-4·5.
5-septate............	20-73 × 3-6..........	Mostly 22-66 × 4-5·3.
8-septate............	30-75 × 3·8-6.......	Mostly 36-71 × 4·2-5·5.
9-septate............	51-83 × 4·5-6.......	Mostly 67 × 5·2.

Chlamydospores intercalary, seldom terminal, mostly in chains or clusters, brown in colour; rarely single, round and 7-14 μ diam. Sclerotia, when present, spherical, brown to dark blue, 60-80 μ diam.

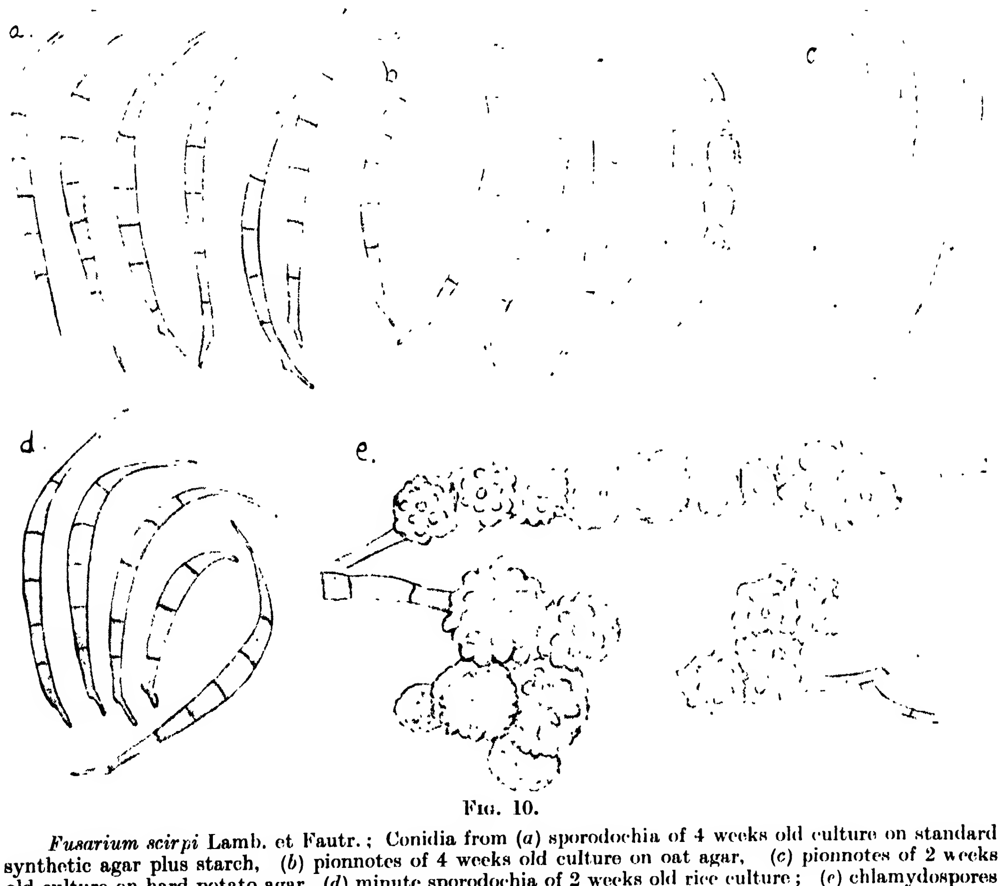

FIG. 10.

Fusarium scirpi Lamb. et Fautr.; Conidia from (*a*) sporodochia of 4 weeks old culture on standard synthetic agar plus starch, (*b*) pionnotes of 4 weeks old culture on oat agar, (*c*) pionnotes of 2 weeks old culture on hard potato agar, (*d*) minute sporodochia of 2 weeks old rice culture; (*e*) chlamydospores from 4 weeks old culture on potato plug.

Hab. *Allium cepa* L., from rotting stems of seedlings, Pyramids, Pretoria dist., March 1932 (Mogg).

Antirrhinum majus L., from stems of wilting plants, Wepener, O.F.S., Pretoria, Transvaal, and Carnarvon, Cape (Wager).

Arachis hypogaea L., on pods and seeds of peanuts attacked in the soil, Pretoria University Farm, 1932 (F. du Toit).

Callistephus chinensis Nees, from stems of wilting aster seedlings, Pretoria (associated with *Rhizoctonia* and *Pythium* sp.) ; Hennops River, Pretoria dist. (Havenga).

Carica papaya L., from rotting pawpaw fruit, Buffelspoort, nr. Marikana, and Warmbaths, Transvaal.

Centaurea cyanus L., from discoloured stem of cornflower, Johannesburg (Wager).

Citrus grandis Osbeck, from bark of grapefruit tree showing gummosis, Patentie, Cape, July 1930.

Citrus Limonia Osbeck, from roots of rough lemon stock showing dry root rot, Elandshoek, E. Transvaal, July 1930 (M.H. 28911) ; Bonnievale, Cape (van der Hoek) M.H. 28430.

Citrus nobilis Lour. var. *deliciosa* Swingle, from twig of naartje tree, associated with *Septobasidium* sp., East London, 1929 (Turner).

Citrus sinensis Osbeck, isolated frequently from oranges showing stem end or navel end rot, after 12–18 weeks in storage (25 strains studied) ; in fruit from Rustenburg, Zebediela, Transvaal, Groot Drakenstein, Cape, and Muden, Natal.

From bark of orange trees showing root and collar rot, Godwan River, E. Transvaal, October 1930 (van der Plank) ; Letaba Estates, N. Transvaal (Matthew).

Crotalaria juncea L., from base of stem of wilting plants of Sunn Hemp, University Farm, Pretoria, 1932 (F. du Toit).

Cucumis sativus L., from cucumbers (fruits), shewing soft rot and leaking, Nelspruit, E. Transvaal (Wager) ; from stems of wilting plants, nr. Port Elizabeth (Haines).

Cucurbita pepo L., on young fruits of vegetable marrow rotting in garden, Irene, nr. Pretoria (Bottomley).

Dianthus caryophyllus L., from stems of dying carnation plants, Golden Valley, Cape (Wager) ; Hartebeestpoort, Transvaal (associated with *Sclerotium Rolfsii*) ; Duivelskloof, N. Transvaal (Wager).

Eleusine indica Gaertn., from stems of goose grass (associated with *Helminthosporium* sp.) Acton Homes, nr. Ladysmith, Natal (L. A. Doidge).

Euphorbia crassipes Marloth, from rotting stems of succulent *Euphorbia*, Williston, Cape.

Kentia sp , on stem of dying palm (associated with *Gloeosporium* sp), Uitenhage, Cape, Sept 1932.

Lathyrus odoratus L , from stems of sweet pea seedlings, which were yellowing and dying off (associated with *Pythium* sp), Brooklyn, Pretoria.

Limonium sp., from crown of dying Statice plants, Nelspruit, E. Transvaal (Wager).

Lycopersicum esculentum Mill., from stems of wilted tomato plant, Windhoek, S.W.A. (Wager) ; petioles of dying plant, Gqaga, Transkei ; from decaying stems, Karino, E. Transvaal (Wager), M.H. 28432 ; from fruits, on " blossom end rot " lesions, Pyramids, Pretoria dist.

Matthiola incana R. Br., from discoloured stem of stock plant, Johannesburg (Wager).

Musa Sapientum L., from surface of decaying fruit, Acornhoek (Boybe).

Papaver nudicaule L., from crown of dying plants, Brooklyn, Pretoria (Wager).

Phlox Drummondii Hook., from stems of wilting plants (ass. *Rhizoctonia*), Brooklyn, Pretoria.

Pinus sp., from stems of seedlings, dying in nursery, Heidelberg, Transvaal, M.H. 28392.

Pisum sativum L., from stems of dying plants, Carnarvon, Cape (Wager).

Pteridium aquilinum Kuhn, from rhizome of diseased bracken plant (associated with *Pythium* sp. and *Pestalotia* sp.), White River, E. Transvaal (Wager).

Pyrus malus L., from brown cores of fruit, Vereeniging, 1935–6 (Bottomley).

Solanum tuberosum L., on tubers showing " dry rot," and on tubers breaking down with " leak " due to *Pythium* sp., Pretoria.

Viscaria viscosa Aschers., from stems of dying plants, Brooklyn, Pretoria.

Icerya purchasi, on Australian bug, on *Mentha* sp., Grahamstown, 1932 (N. Smith).

Nomadacris septemfasciata, on eggs of red locust, hatching in sterilised soil, Pretoria, 1932 (Brooks).

This cosmopolitan species is extremely common in South Africa on dead or dying parts of plants. It appears frequently to invade plant tissues which have been attacked by other fungi or otherwise injured, and to be a secondary cause of decay.

Growth on Standard Media.

Oat agar: Aerial mycelium not abundant, fine, white, cottony; after 7 days, very minute sporodochia were developing all over the face of the slant, these were very numerous and in places coalesced, but for the most part remained discrete. Sporodochia pale ochraceous salmon to light vinaceous cinnamon.

Hard potato agar: Aerial mycelium fairly abundant, fine, white, cottony to cobwebby; after 14 days, a copious pionnotes had developed on the substratum; this was at first ochraceous salmon, and later salmon buff and vinaceous cinnamon.

Standard synthetic agar plus starch: Aerial mycelium not very abundant, fine, white, cobwebby. Pionnotes copious, in one case showing a tendency to develop in concentric rings round the point of transfer; pionnotes light ochraceous salmon or buff pink, becoming salmon buff to light vinaceous cinnamon.

Potato agar plus 5 per cent. dextrose: After 7 days, aerial mycelium was fairly abundant, white, cottony; growth on substratum congo pink. After 14 days, growth on the substratum was dark olive buff, and the medium was stained olive brown to vandyke brown.

Potato plug: Aerial mycelium scanty to moderate in amount, cottony to cobwebby at first white, but after 4 weeks, becoming flattened and felt-like, and olive buff in colour, owing to the presence of numerous chlamydospores. Growth on substratum became snuff brown to warm sepia, and the medium was stained buffy brown. Pionnotes developed freely after 7 days, on the substratum, and were buff pink to light vinaceous cinnamon.

Melilotus stem: Aerial mycelium fairly abundant, at first white cottony, but after 4 weeks, rather flattened and felt-like, and brownish white in colour. Pionnotes formed freely, and practically covered the stems; they were pinkish cinnamon to cinnamon.

Bean pod: Aerial mycelium scant to copious, in the latter case almost filling the tube. Numerous small sporodochia developed, many of which coalesced in patches and formed a continuous pionnotes; they were pinkish cinnamon to vinaceous cinnamon.

Rice: Mycelium at first white to pale flesh colour; growth on substratum snuff brown, and grains stained the same colour. After 4 weeks, the aerial mycelium was still white, but shading to snuff brown near the grains. Minute sporodochia were fairly numerous, and were light vinaceous cinnamon; where the conidia had dried to a powder at the surface of the medium, they were vinaceous pink.

Measurements of Conidia.

Hard potato agar, culture 14 days old, conidia from pionnotes—

9-septate............	Few..................	82·5 × 5.
8-septate............	Few..................	75–80 × 5.
7-septate............	2·5 per cent........	35–67·5 × 3·75–5.
6-septate............	4·5 ,, ...	52–70 × 5.
5-septate............	90 ,, ...	42–62·5 × 3–5, mostly 50–57·5 × 3-4·5.
4-septate............	2·5 ,, ...	42·5–52·5 × 3·75–5.
3-septate............	0·5 ,, ...	30–35 × 3·5–5.

Bean pod, culture 14 days old, conidia from pionnotes—

6-septate............	Few..................	52·5 × 5.
5-septate............	94 per cent..........	37·5–60 × 4–4·5, mostly 40–50 × 4–4·5.
4-septate............	2 ,, ...	37·5–51 × 4–4·5.
3-septate............	4 ,, ...	30–37·5 × 3·5–4.

Melilotus, stem, culture 14 days old, conidia from pionnotes—

6-septate............	1·5 per cent........	55–62·5 × 4–5.
5-septate............	90 ,, ...	32·5–62·5 × 3·75–5.
4-septate............	5 ,, ...	35–45 × 3·75–5.
3-septate............	3·5 ,, ...	25–37·5 × 3·75–4·5.

On standard synthetic agar plus starch, the conidia from pionnotes were almost all 5-septate, 40–72·5 × 3–4·5 ; other septations were rare. On oat agar, the conidia were also 99 per cent. to 100 per cent. 5-septate ; they were 40–67·5 × 3–4·5.

Fusarium scirpi Lamb. et Fautr. var. **compactum** Wr.

Wollenweber, Fusarium-Monographie, 333, 1931 ; Fus. aut. del. 923–925. Wollenweber and Reinking, Die Fusarien, 66–67, 1935.

Syn. *Fusarium scirpi* Lamb. et Fautr. v. *compactum f. 1.* Wr.

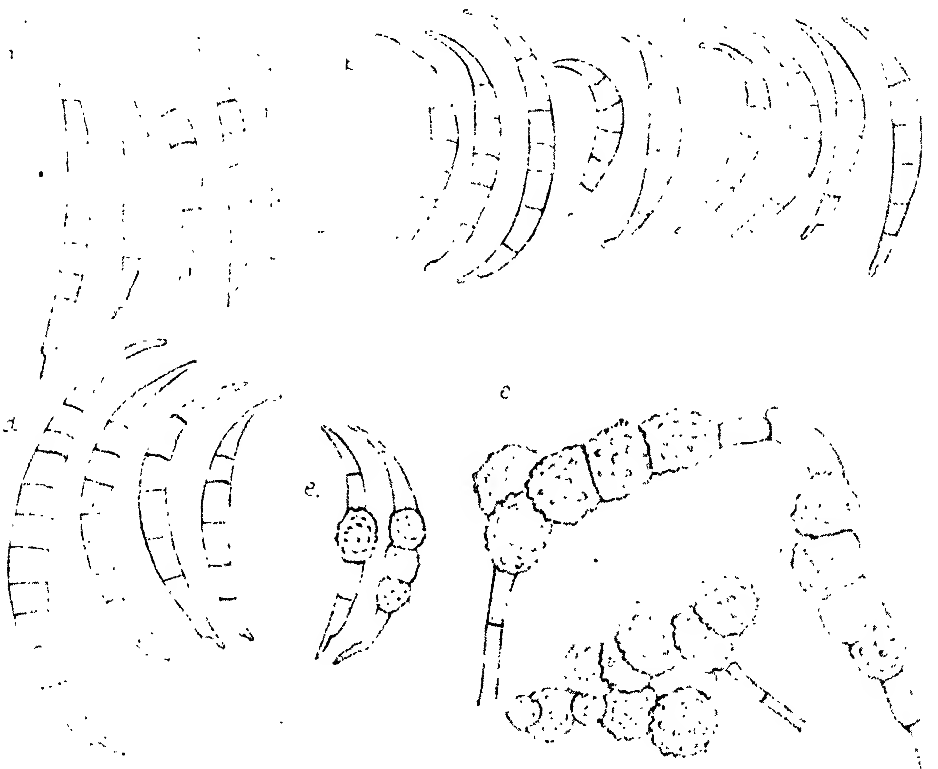

Fig. 11.

Fusarium scirpi Lamb. et Fautr. v. *compactum* Wr. ; Conidia from (*a*) sporodochia of culture on bean pod, (*b*) pionnotes of culture on standard synthetic agar plus starch, (*c*) pionnotes of culture on oat agar, (*d*) pionnotes of culture on hard potato agar. Culture all 2 weeks old.

This variety differs from *Fusarium scirpi* in the form of its macroconidia, which are more compact; they are comparatively short and broad, and the apical cell is not drawn out into a filamentous process. Conidia mostly 5-septate, more rarely 3–4-septate, seldom 0–2- or 6–7-septate.

3-septate............	17–40 × 3·5–6.......	Mostly 25–31 × 4·2–5·4.
5-septate............	30–55 × 3·7–6·5.....	Mostly 36–47 × 4·3–6.
7-septate............	37–52 × 4·5–6.......	Average 42 × 5.

On media rich in carbohydrates, the stroma may assume a carmine red and golden yellow colour, which sometimes deepens to brown ochre. The red colour is sometimes pronounced, but may be weak or absent. The form previously described as *f.* 1 has no red colour in the stroma. Chlamydospores like those of the type, mostly intercalary, and often distinctly verrucose when mature, especially after drying.

Hab. *Antirrhinum majus* L., from stem of wilting plant, Pretoria (Wager).

Campanula medium L., from stem of wilting Canterbury Bell, Kimberley(Wager).

Citrus sinensis Osbeck, from fruit held in storage for 12–18 weeks; from stem end rot of Valencia oranges from Rustenburg and Zebediela, Transvaal, and from navel end rot of navel oranges from Letaba, N. Transvaal.

From bark of branch affected with scaly bark, Mazoe Estates, Rhodesia (Bates); from citrus trunk showing extensive bark lesions and some gummosis, Letaba, N. Transvaal.

Cucumis sativus L., from cucumbers shewing soft rot and leaking, Nelspruit (Wager).

Lathyrus odoratus L., from stems of wilting sweet pea seedlings, Brooklyn, Pretoria (Wager), M. H. 28416.

Limonium sp., from stems and crowns of dying Statice plants, Nelspruit (Wager).

Matthiola incana R. Br., from discoloured stem of stock plant, Johannesburg (Wager).

Papaver Rhoeas L., from stems of Shirley poppy, which was yellowing and dying (ass. *Rhizoctonia*), Pretoria (Wager).

Striga lutea Lour., from stems of dying plants, Ixopo, Natal (Mack).

Growth on Standard Media.

In culture this strain resembles *Fusarium scirpi*, except that in some strains there is carmine or yellow colour in the stroma. In the strains on *Campanula*, *Cucumis* and *Limonium*, the stroma on oat agar and standard synthetic agar plus starch was eugenia red to pomegranate purple, and it was carmine on potato agar plus 5 per cent. dextrose; the red colour was more definite in some sets of cultures than in others.

Measurements of Conidia.

Standard synthetic agar plus starch, culture 14 days old, conidia from pionnotes—

7-septate............	Rare.	
6-septate............	Rare.	
5-septate............	86 per cent..........	30–47·5 × 3·75–6.
4-septate............	8 ,, ...	25–37·5 × 3·75–6.
3-septate............	6 ,, ...	27·5–30 × 3·75–5.

Hard potato agar, culture 14 days old, conidia from pionnotes—

7-septate............	1 per cent........	46–55 × 5.
6-septate............	1·5 ,, ...	52·5–53 × 5.
5-septate............	81 ,, ...	35–56 × 4–6.
4-septate............	11·5 ,, ...	35–45 × 4–5.
3-septate............	5 ,, ...	20–47·5 × 3·75–5.

Potato plug, culture 14 days old, conidia from pionnotes—

5-septate............	63 per cent..........	27·5–37·5 × 5–6.
4-septate............	15 ,, ...	20–35 × 4·5–5.
3-septate............	22 ,, ...	20–27·5 × 4·5–5.

Plain agar plates, culture 12 days old, conidia from mycelium—

10–12-septate............	9 per cent..........	55–70 × 5–6.
7–9-septate............	16 ,, ...	50–60 × 5–6.
5–6-septate............	65 ,, ...	35–50 × 4·5–5.
3–4-septate............	10 ,, ...	30–35 × 5.

The figures given above are for conidia developing on one set of plain agar plates; on this occasion the conidia formed had a higher number of septations than on any other medium.

Chlamydospores numerous, usually in chains or clusters. In potato cultures 4 weeks old, they were smooth and hyaline, becoming brown and verrucose as they matured, single spores being 10–15 μ diam. Chlamydospores also occurred in the conidia in some of the older cultures.

Fusarium scirpi Lamb. et Fautr. var. **acuminatum** (Ell. et Ev.) Wr.

Wollenweber, Fusarium-Monographie, 335, 1931; Fus. aut. del. 165-168, 170, 569, 930–933. Wollenweber and Reinking, Die Fusarien, 67–68, 1935.

Syn. *Fusarium acuminatum* Ell. et Ev.; *Fusidium aloes* Kalch. et Cke.
Fusarium arcuosporum Sherb.; *F. erubescens* App. et Ov.
F. ferruginosum Sherb.
F. hippocastani (Cda.) Sacc.; *Selenosporium hippocastani* Cda.
Fusarium lanceolatum Pratt; *F. pseudoeffusum* Mur.
F. russianum Manns; *F. sanguineum* Sherb. (non Fries.).

Fig. 12.

Fusarium scirpi **Lamb. et Fautr. v.** ***acuminatum*** **(Ell. et Ev.) Wr. conidia from pionnotes of 8 weeks old cultures on (*a*) hard potato agar, (*b*) potato agar plus 5 per cent. dextrose, (*c*) bean pod, and (*d*) standard synthetic agar plus starch; (*e*) chlamydospores from 4 weeks old culture on hard potato agar.**

Stroma plectenchymatous, of various colours, blood red, purple, yellow, sometimes sclerotially erumpent and dark blue, brown or pale. Aerial mycelium white or pink. Conidia in sporodochia and pionnotes, orange-coloured, falcate, tapering at both ends, apex more or less elongated, base pedicellate or papillate, occasionally rounded to truncate, 5-septate, less frequently 3–4-septate, exceptionally 0–2- or 6–7-septate.

0-septate............	4–12 × 2–5..........	Average 8·6 × 3.
1-septate............	11–12 × 2·2–4.......	Average 15 × 2·8.
3-septate............	16–44 × 2·5–4·5.....	Mostly 21–37 × 3–4·2.
5-septate............	28–61 × 3–5·3......	Mostly 34–54 × 3·1–4·3.
7-septate............	45–84 × 3·2–5·2.....	Mostly 41–61 × 3·8–5.

Chlamydospores intercalary, mostly in chains and clusters, seldom terminal, in conidia often 1- or 2-celled, spherical, 7–20 μ diam., 1-septate 20–30 × 10–18; brown in mass.

This variety has much the same distribution as the type, and occurs on a number of plants in almost all parts of the world. The ascus stage has been observed in Europe and Australia on *Acer*, *Dahlia* and maize. It may be briefly characterised as follows:

Gibberella acuminata Wr.

Wollenweber and Reinking, Die Fusarien, 68, 1935. Wollenweber, Fus. aut. del. 1107, 1108.

Syn. *Gibberella saubinetii* (Dur. et Mont.) f. *dahliae* Sacc.

Nectria dahliae Rich.

Perithecia olive-green to blue black, spherical to conical, rough, 0·3–0·5 mm. diam., single or in small groups, loosely attached to the olive-coloured stroma. Asci mostly 8-spored. Spores fusiform, broadly conical at both ends, slightly curved, 3 (1–3) -septate.

3-septate............	17–36 × 4–9.........	Mostly 22–26 × 5–6.
1-septate............	13–25 × 4–9.........	Mostly 16–22 × 5–8.

The ascus stage has not been found in South Africa, but the conidial stage has been isolated from several hosts.

Hab. *Dianthus caryophyllus* L., from stems of carnation plants affected by foot rot or wilt (in the latter case associated with *F. dianthi*), Bethlehem, O.F.S., Sterkstroom, Transvaal, and Estcourt, Natal, Feb. 1936.

Phaseolus sp., from stems of bean plants which made good growth but set no seed, Premier Cotton Estates, Mvamba.

Solanum tuberosum L., from " seed " tubers, imported from Hamburg, Germany.

Zea Mays L., from base of stem of plant affected by foot rot (*F. moniliforme* also isolated) Lourenco Marques (Fuller), M.H. 23222; Premier Mine, Transvaal (Leemann).

Fusidium aloes Kalch. et Cke. (Grevillea, 22, 1880), which is probably a synonym for *Fusarium scirpi* v. *acuminatum*, was collected by MacOwan in South Africa in 1879, on the leaves of *Aloe arborescens* (Herb. MacOwanianum No. 1170; Wr. Fus. aut. del. 167). This number is unfortunately missing from the collection of MacOwan's fungi in the Cryptogamic herbarium.

Growth on Standard Media.

Oat agar: Aerial mycelium abundant, cottony, mostly white, but with patches of yellow ochre where it touched the tube. Growth in substratum spinel red to pomegranate purple.

Hard potato agar: Mycelium not very plentiful, tufted, cottony. Pionnotes and small sporodochia developed in 2–4 weeks, they were pinkish cinnamon, and developed directly on the substratum; they were partially concealed by the aerial mycelium.

Standard synthetic agar plus starch: Aerial mycelium scanty, white, cottony; growth in substratum isabella colour to old rose and spinel red, or cinnamon rufous in places. After 6 weeks, pinkish cinnamon pionnotes developed in concentric rings round the point of transfer.

Potato agar plus 5 per cent. dextrose: After 14 days, aerial mycelium was very plentiful, white to ochraceous buff and Chatenay pink, or occasionally geranium pink; after 4 weeks it was white to spinel red.

Potato plug: Plug covered with a dense, matted mycelium, which was white to sea-shell pink, with patches of chamois colour at the base, and pinkish cinnamon where it touched the glass. Growth on substratum was eugenia red to acajou red.

Melilotus stem: Stems covered with a copious aerial mycelium which was white or tinged with pink.

Bean pod: Pod covered with a copious aerial mycelium, which was cottony to arachnoid and tufted; it was white to vinaceous buff and vinaceous pink.

Rice: In cultures 10 days old, the mycelium was white at the surface of the medium; below it was mustard yellow, and, at the base, eosine pink to begonia rose. The pink colour faded after 4 weeks. The mycelium between the grains was then mostly yellow ochre, and the growth in the substratum mummy brown.

Measurements of Conidia.

Standard synthetic agar plus starch, culture 8 weeks old, conidia from sporodochia and pionnotes—

5-septate............	58 per cent..........	28·75-55 × 3-6.
4-septate............	32 ,, ...	30-42·5 × 3-5.
3-septate............	6 ,, ...	22·5-40 × 3-5.
0-septate............	4 ,, ...	13-15 × 3-3·25.

Hard potato agar, culture 8 weeks old, conidia from pionnotes—

6-septate............	3·5 per cent........	27·5-40 × 5-6.
5-septate............	58 ,, ...	25-41·5 × 5-6.
4-septate............	16 ,, ...	20-40 × 4·5-5·5.
3-septate............	16·5 ,, ...	25-38 × 3·75-4·5.
2-septate............	2 ,, ...	25 × 4.
1-septate............	3 ,, ...	12·5-20 × 3·75.
0-septate............	1 ,, ...	15 × 3-3·25.

On plain agar plates, chlamydospores developed after 6 days. They were mostly intercalary, in chains or irregular clusters; single cells were 5-10μ diam., sparsely verrucose, becoming olivaceous at maturity.

Fusarium scirpi Lamb. et Fautr. var. **filiferum** (Preuss) Wr.

Wollenweber, Fusarium-Monographie, 337-338, 1931; Fus. aut. del. 219-222, 601, 936. Wollenweber and Reinking, Die Fusarien, 69, 1935.

Syn. *Fusarium filiferum* (Pr.) Wr.; *Fusoma filiferum* Preuss.
Fusarium caudatum Wr. v. *solani* Sherb.; *F. equiseticola* All.
Fusisporium incarnatum Rob. v. *tussilaginis farfarae* Sacc.
Fusarium mycophytum (W. G. Sm.) Mass.; *Fusisporium mycophytum* W. G. Sm.
Fusarium osteophilum Speg.

Stroma effuse, sometimes sclerotially erumpent, and then brown; aerial mycelium white, floccose. Conidia in sporodochia or pionnotes, ochraceous or amber yellow to brown ochre, with whip-like elongation of the apical cell, and base with a long foot. Conidia 5-7-septate, less frequently 3-4- or 8-10-septate, exceptionally up to 12-septate. In young cultures, subnormal, *Fusisporium*-like conidia are found scattered in the mycelium; they are smaller, oval to fusiform, rounded to conical at both ends, straight or somewhat curved.

0-septate............	5-10 × 2·7-4........	Average 7·7 × 3·3.
1-septate............	9-16 × 3-4..........	Average 13 × 3·5.
3-septate............	19-40 × 2-5.........	Mostly 23-34 × 2·5-4·4.
5-septate............	22-87 × 2·5-6.......	Mostly 35-76 × 3·3-4·5.
7-septate............	50-114 × 3·2-6·5....	Mostly 57-84 × 3·7-5·1.
9-septate............	58-121 × 3·5-6......	Mostly 77-90 × 4-5.
11-12-septate............	60-132 × 3·5-5·5.	

Chlamydospores 6–16 μ in diameter, round or oval, intercalary, smooth or verrucose, usually in chains and clusters.

Hab. *Allium Cepa* L., on rotting stems of onion seedlings, Pyramids, Pretoria dist., March 1932 (Mogg) (seedlings dying from attack of *F. oxysporum f.* 7).

Nomadacris septemfasciata, recorded as occurring on red locusts in South West Africa (Wollenweber and Reinking, loc. cit.).

This variety occurs on decaying parts of plants, and on other fungi, in Europe and North America.

FIG. 13.

Fusarium scirpi Lamb. et Fautr. v. *filiferum* (Wr. et Rkg.) Wr.; Conidia from (*a*) pionnotes of 4 weeks old culture on hard potato agar and (*b*) sporodochia of 4 weeks old culture on oat agar.

Growth on Standard Media.

Oat agar : Aerial myceluim fairly abundant, white, tufted, cottony. Growth in substratum at first colourless, with a tinge of pinkish buff at the base of the slant; after 4 weeks, the stroma at the base of the slant became sclerotially erumpent and brown. Sporodochia few, scattered, cream buff to ochraceous buff.

Hard potato agar : Mycelium white, cottony, not abundant. Growth in substratum colourless. Sporodochia resembled those on oat agar.

Standard synthetic agar plus starch : Aerial mycelium sparse; cultures 14 days old had a tinge of pinkish buff in the substratum at the base of the slant, which faded to ochraceous tawny in 4 weeks.

Potato agar plus 5 per cent. dextrose : Aerial mycelium fairly abundant, at first white, later flecked with brown. Growth in substratum at first pinkish buff, becoming ochraceous tawny to snuff brown after 4 weeks; stroma sclerotially erumpent at the base of the slant, as on oat agar. Pionnotes along needle track, russet colour.

Potato plug : Plug covered with fine, cottony mycelium, which was white at first but became brownish with age. There were mummy brown patches in the substratum.

Melilotus stem : Stems covered with a very vigorous, white, cottony mycelium, which completely concealed the sporodochia which developed round the point of transfer.

Bean pod : Pods covered with a fine white mycelium. A number of small sporodochia developed in a group round the point of transfer, elsewhere they were scattered; sporodochia cinnamon colour.

Rice : Growth at first white to pinkish buff, gradually becoming brown.

Measurements of Conidia.

Hard potato agar, culture 14 days old, conidia from sporodochia—

7-septate............	5 per cent..........	56–79 × 4–5·5.
6-septate............	10 „	55–75 × 3–5.
5-septate............	80 „	45–72·5 × 3–5.
4-septate............	4 „	42·5–57·5 × 3·4–5.
3-septate............	1 „	32·5–40 × 2·8–4·4.

Bean pod, culture 14 days old, conidia from sporodochia—

8-septate............	Rare..................	57·5–60 × 4·7–5.
6-septate............	6 per cent..........	52·5–60 × 3·75–5.
5-septate............	86 „	35–59 × 2·8–4·7.
4-septate............	6 „	35–37·5 × 2·8–4·7.
3-septate............	2 „	32·5–47·5 × 3–3·75.

Section DISCOLOR.

Wollenweber, Fusarium-Monographie, 346, 1931. Wollenweber and Reinking, Die Fusarien, 69–70, 1935.

Macroconidia comparatively thick-walled, fusiform-falcate, tapering at both ends, curved (dorsal side convex, ventral side less curved, usually concave but occasionally somewhat convex); apex constricted like the neck of a bottle, curved and rostrate, or conical to truncate or rounded; base pedicellate, when fully developed and mature. Sporodochia and pionnotes ochre, salmon pink or orange. A few species have a *Fusisporium* stage, with smaller or medium-sized conidia, which are apedicellate, 0–3- or more-septate, oval, fusiform to cylindrical, straight or curved; these forms may predominate, or may disappear with the formation of sporodochia (as in *F. trichothecioides*). Other species have some comparatively slender conidia, and some more compact (*F. heterosporum*). The stroma is flat, effuse; it is plectenchymatous, here and there sclerotially erumpent, and varied in colour; it may be pale, carmine to purple red, yellow, brown, or rarely blue; in a few forms it is pale and homogeneous. Spherical sclerotia may be present or wanting; when present they are blue, brown or colourless. Aerial mycelium well developed, white, pink, or tinged with the colour of the stroma. Chlamydospores few, terminal or intercalary, single, in chain or in clusters; brown in mass. It has been established that the ascus stage of some of the species is *Gibberella*.

Sub-sections of the Discolor-Fusaria.

A.—Apedicellate conidia of the *Fusisporium*-stage predominant. Mycelium floccose, *Trichothecium*-like...... *Trichothecioides*.
AA.—Pedicellate conidia predominant, developing in pionnotes and sporodochia.
  B.—Triseptate conidia typically 3–4·1 μ thick....... *Neesiola*.
  BB.—Triseptate conidia typically 4·1–7·9 μ thick..... *Saubinetii*.

Key to the South African Species.

A.—Macroconidia 4–5 (5·5) μ thick, 3–5-septate.
  B.—Stroma carmine to purple red, chestnut brown, yellow or pink.
    C.—Conidia not typically heterosporus, usually in sporodochia.
      D.—Conidia comparatively compact, in sporodochia and pionnotes.
        E.—Conidia mostly 3-, seldom 4–5-sept.: 3-sept. 25 × 4·9: 5-sept. 30 × 5·3 *F. sambucinum f.* 2.

EE.—Conidia 3–5-sept..................	*F. sambucinum.*
DD.—Conidia comparatively elongated, slender; conidia 3-5-sept.......................	*F. graminearum.*
CC.—Conidia typically heterosporous, compact or slender..................................	*F. heterosporum v. congoense.*
BB.—Stroma not becoming carmine to purple red......	*F. sambucinum f. 6.*
AA.—Macroconidia 5–9 μ thick, 5 (3–5–7) -sept..........	*F. culmorum.*

Sub-section NEESIOLA.

Wollenweber, Ann. Myc. 15 : 2, 1917 ; Fusarium-Monographie, 346, 1931. Wollenweber and Reinking, Die Fusarien, 70–74, 1935.

Stroma floccose, effuse, often covered by a pionnotal layer, flat, more rarely sclerotially erumpent. Sporodochia formed less frequently than pionnotes. Conidia slender, 3–4 μ thick, more or less 3-septate, salmon colour, reddish or orange in mass, becoming brick red when dry. Mycelium yellow or flesh colour, rarely carmine. Chlamydospores intercalary or none.

Fusarium heterosporum Nees var. **congoense** Wr.

Wollenweber, Fusarium-Monographie, 350, 1931 ; Fus. aut. del. 306–307, 612, 1140, 1141. Wollenweber and Reinking, Die Fusarien, 73, 1935.

Syn. *Fusarium congoense* Wr. ; *F. congoense* v. *septatius* Wr. (nom. nud.).
F. heterosporum Nees v. *congoense f. 1.* Wr.

Sporodochia orange to brick red, gelatinous, early coalescing to form a pionnotal layer. Conidia typically fusiform to falcate, some compact, others slender, curved, tapering at both ends, pedicellate ; apical cell in the more compact conidia constricted or rostrate ; in the more slender forms tapering gradually and curved ; the slender forms approach the *Roseum* type. Stroma loose, floccose, with abundant aerial mycelium which is white, or citron yellow to sulphur yellow and flesh colour ; plectenchymatous layer on the substratum carmine red. Conidia scattered in false heads or in sporodochia and pionnotes, borne on conidiophores which branch more or less freely. Conidia mostly 3-5 septate, seldom 0-2-septate, or 6-10-septate.

3-septate, 22-40 × 2·7–6, mostly 26-39 × 3·1-5·2 (some compact, av. 29 × 4·8, others more slender, av. 33 × 3·4).

5-septate, 29–45 × 2·7-7, mostly 32–42 × 3·1–5·7 (some 37 × 5·2, others 43 × 3·6).

7-septate, 38-54 × 3-6, mostly 41–45 × 4·1-5·5.

9-septate, 56 × 5·5.

Chlamydospores intercalary.

Hab. *Brachiaria brizantha* Stapf, on ovaries, Experiment Station, Barberton, Transvaal, April 1914 (Mogg) M.H. 7771 ; Salisbury, Rhodesia, March 1919 (Eyles) M.H. 11858.

Brachiaria sp., on ovaries infected with ergot, Salisbury, Rhodesia, Feb. 1915 (Walters) M.H. 8868.

Bromus unioloides H.B.K., on ovaries infected with *Ustilago bromivora*, Rietpoort Zandspruit, Wakkerstroom Dist., Transvaal, April 1907 (Gillespie) M.H. 284-285. (This is apparently the type collection, quoted by Wollenweber in the Fuasrium-Monographie, p. 350, as from " Zandspruit, Wakkerstroom Dist., Congo, Central Africa, Vanderyst F. 284-285 " ; the fungi in the National Herbarium were at one time distinguished by the letter F.).

Cynodon dactylon Pers., on ovaries infected with smut, Skinner's Court, Pretoria, Feb. 1918 (Mogg) M.H. 11673 ; without locality (Burtt Davy) M.H. 577.

Digitaria eriantha Steud., on ovaries, Butterworth, Cape, April 1914 (Pegler) M.H. 7743.

Digitaria monodactyla (Nees) Stapf, on ovaries infected with ergot, Groenkloof, Pretoria, Dec. 1919 (Pole-Evans) M.H. 11874.

Digitaria Pentzii Stent (Woolly Finger Grass), on ovaries infected with ergot, Durban, Feb. 1929 (Clarkson) M.H. 23684 ; Prinshof, Pretoria, April 1930 (Liebenberg) M.H. 25369.

Hyparrhenia hirta Stapf, on ovaries, Garstfontein, Pretoria Dist., March 1915 (Pienaar) M.H. 8905.

Panicum laevifolium Hack., on ovaries infected with smut, Tzaneen, N. Transvaal, April 1906, M.H. 6.

FIG. 14.

Fusarium heterosporum Nees v. *congoense* Wr. ; (*a-b*) conidia from natural host, (*a*) stout form, (*b*) slender form ; (*c-e*) conidia from cultures ; (*c*) from mycelium of 3 weeks old culture on plain agar, (*d*) from sporodochia of 8 weeks old culture on rice, (*e*) from sporodochia of 8 weeks old culture on oat agar.

Panicum maximum Hack., on ovaries infected with ergot, Kentani, Cape, May 1913 (Pegler) M.H. 6649 and 6919; Butterworth, Transkei, April 1914 (Pegler) M.H. 7738; Maritzburg, Natal, April 1914 (Sim.) M.H. 7760; Groenkloof, Pretoria, Feb. 1915 (Pole Evans) M.H. 9058; Moodie's Estates, Barberton, Transvaal, March 1932 (Wager) M.H. 26152.

Pennisetum cenchroides Nees, on ovaries infected with ergot, Prinshof, Pretoria, March 1934 (Mogg) M.H. 26147.

Setaria nigrirostris Dur. et Sch., on ovaries, Leeuwpoort, Carolina Dist., (Burtt Davy) M.H. 480.

Setaria perennis Hack., on ovaries, Groenkloof, Pretoria, Feb. 1919 (Phillips) M.H. 11878.

Setaria sphacelata Stapf et Hub., on ovaries infected with ergot, Garstfontein, Pretoria Dist., March 1915 (Pienaar) M.H. 8906.

Sorghum vulgare Pers. v. *caffrorum* (Thun.) Hubb. et Rehd. (= *Andropogon sorghum*), on ovaries infected with smut, *Sphacelotheca sorghi*, Clercqsvlei, Moedig, Transvaal.

Growth on Standard Media.

Oat agar: Aerial mycelium rather sparse, white, tufted, cottony; after 4 weeks, growth on substratum barium yellow. A number of small, scattered sporodochia developed on the lower part of the slant, and were bittersweet pink in colour.

Hard potato agar: Aerial mycelium sparse to moderate, thin, cottony, white. Very numerous minute sporodochia developed on the lower part of the slant, and were salmon colour.

Standard synthetic agar plus starch: Aerial mycelium fairly plentiful, fine, cottony, white, or tinged thulite pink and naples yellow; growth on substratum spinel red in places. Groups of sporodochia 0·5 to 2·5 mm. in diameter, developed in 4–8 weeks, and were salmon orange to bittersweet pink.

Potato agar plus 5 per cent. dextrose: Aerial mycelium dense, rather tufted, cottony, at first white to safrano pink, grenadine pink and chamois colour. The colour faded somewhat after 14 days, and was then white and pale salmon colour. Growth on substratum eugenia red to pomegranate purple and Bordeaux red. Sporodochia not numerous, bittersweet pink.

Potato plug: Aerial mycelium very abundant, felt-like, white to deep rose pink; growth on substratum pomegranate purple. No spore masses were observed.

Melilotus stem: Aerial mycelium moderate to copious in amount, white, cottony. Sporodochia orange pink.

Bean pod: Mycelium rather abundant, cottony, white, or with patches of salmon buff in places. No conidial masses observed.

Rice: Growth white to spinel red and pomegranate purple; in a second set of cultures, after the fungus had been in culture for some months, the growth was white to flesh colour. In 4 to 8 weeks, a number of sporodochia developed; they were bittersweet pink.

Measurements of Conidia.

A.—Direct from the host.

M.H. 284–285, on ovaries of *Bromus unioloides* (type collection).

Conidia mostly 5-septate, some 3–4- and some 6–7-septate.

6–7-septate..............	37–40 × 5–5·5 or 40–57·5 × 4.
5-septate..............	30–45 × 4–6·25 or 32·5–42·5 × 3–4.
4-septate..............	30–37·5 × 3·7–4.
3-septate..............	25–27·5 × 3·7–5 or 32·5 × 3.

M.H. 8905, on ovaries of *Hyparrhenia hirta*.

Conidia mostly 3–5-septate, some 6–9-septate.

9-septate..............	55–57·5 × 5·5–6.
8-septate..............	45-52·5 × 6·25.
7-septate..............	45–55 × 5–6.
6-septate..............	32·5–47·5 × 5–6·25.
5-septate..............	30–47·5 × 4·5–6 or 37–42·5 × 3·7.
4-septate..............	30–32·5 × 4–5.
3-septate..............	27·5–37·5 × 4–6.

M.H. 11673, on ovaries of *Cynodon dactylon*.

Conidia mostly 3–5-septate.

6–7-septate..............	37·5–40 × 5.
5-septate..............	32·5–42·5 × 5·5 6·25 or 35–37·5 × 3·7–4.
4-septate..............	30 × 5 or 37·5–40 × 3·7.
3-septate..............	30 × 4 or 27·5–40 × 3–3·7.

M.H. 11878, on ovaries of *Setaria perennis*.

Conidia mostly 5-septate, 3-4- and 6–7-septate fairly common, some 8–10-septate.

8–10-septate..............	42·5 57·5 × 5·5–6·26.
7-septate..............	37·5–50 × 5–6.
5-septate..............	27·5–50 × 5–6 or 37·5–50 × 3·7–4.
4-septate..............	37·5–40 × 4·5.
3-septate..............	22·5–27·5 × 5–5·5 or 25–27·5 × 3–3·7.

B.— From culture derived from M.H. 23684, on ovaries of *Digitaria Pentzii*.

Maize stem, culture 6 weeks old, conidia from sporodochia.

5-septate............	73	per cent........	37–45 × 3·4–4.
4-septate............	2·5	,, ...	32·5–45 × 3–3·5.
3-septate............	23	,, ...	25–35 × 3–3·5.
1-septate............	1·5	,, ...	25–35 × 3–3·5.

Hard potato agar, culture 6 weeks old, conidia from sporodochia.

7-septate............	1	per cent........	51–55 × 2·8–3·75.
6-septate............	1	,, ...	52·5–57·5 × 2·8.
5-septate............	52·5	,, ...	32·5–55 × 2·5–3·75.
4-septate............	21·5	,, ...	35–47·5 × 2·5–3·75.
3-septate............	24	,, ...	22·5–40 × 2·3–3·75.

Oat agar, culture 8 weeks old, conidia from sporodochia.

5-septate............	27	per cent..........	32·5–55 × 3·75–4·7.
4-septate............	36	,, ...	37·5–57·5 × 2·5–2·8.
3-septate............	36	,, ...	37·5–51·5 × 2·5–2·8.
2-septate............	1	,,	

Slender forms predominated in culture; the following are measurements of conidia of the same strain from pionnotes on the ovaries of *Digitaria Pentzii*

6–8-septate............	Rare	....	42·5–55 × 3·75–5.
5-septate............	31	per cent..........	35–45 × 3·75–5·25.
4-septate............	16	,, ...	27·5–40 × 2·8–5.
3-septate............	45	,, ...	20–50 × 3·5–4·75.
2-septate............	2	,, ...	22·5–37·5 × 2·8–3·75.
1-septate............	6	,, ...	35–37·5 × 2·5–2·8.

A few intercalary chlamydospores were seen on potato agar plus 5 per cent. dextrose; they were 6–10 μ diam. and rough walled.

Sub-section SAUBINETII.

Wollenweber, Fusarium-Monographie, 346-347, 1931. Wollenweber and Reinking, Die Fusarien, 70, 75, 1935.

Differs from sub-section *Neesiola* in the larger conidia, 4–5·9–13 μ in diameter, and 3–5–7–12-septate, some compact, some more elongated, generally rather pale, yellow-white, pale orange or ochraceous. Stroma carmine or yellow.

Fusarium sambucinum Fuck.

Fuckel, Symbolae myc., 167, 1869. Wollenweber, Fusarium-Monographie, 352-356, 1931; Fus. aut. del. 311–320, 322, 323, 607, 1142–1144. Wollenweber and Reinking, Die Fusarien, 75-76, 1935.

FIG. 15.

Fusarium sambucinum Fuck.; Conidia from (*a*) sporodochia of culture on bean pod, (*b*) pionnotes of culture on oat agar, (*c*) pionnotes of culture on Melilotus stem, (*d*) sporodochia of culture on hard potato agar, (*e*) pionnotes and (*f*) mycelium of culture on standard synthetic agar plus starch, (*g*) mycelium on oat agar, (*a-b*) from cultures 2 weeks old, and (*c-g*) grom cultures 4 weeks old.

Syn. *Fusarium aridum* Pratt ; *F. Delacroixii* Sacc.
F. fraxini All. ; *F. discolor* App. et Wr.
F. discolor App. et Wr. v. *triseptatum* Sherb.
F. granulare Kalch. ; *F. herbarum* (Cda.) Fr. v. *conii-maculati* Roum. pr. p.
F. hordei (W. G. Sm.) Sacc. ; *F. maydis* Kalch.
F. pannosum Mass. ; *F. pulvinatum* (Berk. et Br.) Sacc.
F. ricini (Bér.) Bizz. ; *F. roseum* Link. pr. p.
F. sambucinum v. *medium* Wr. ; *F. subcarneum* Crouan.
F. tenellum Sacc. et Briard ; *F. tenuissimum* (Peck) Sacc.
Microcera tasmanica McAlp. ; *Discofusarium tasmaniense* Petch.
Pionnotes vagans Speg. ; *Fusarium violaceum* Crouan (non Fuck.).

Conidia fusiform-falcate, curved, somewhat abruptly bent inwards at both ends, constricted or conical at the apex, pedicellate at the base, thick-walled. Macroconidia borne on the aerial mycelium are sometimes mixed with 0-septate, subnormal conidia of different form. Aerial mycelium at first white, then golden yellow or pink. Macroconidia in sporodochia and pionnotes pink to salmon and orange red in mass, sometimes carmine red to chestnut brown or ochre by absorption of the colour of the plectenchymatous or sclerotially erumpent stroma. Conidia 3 5-, seldom 6 7-septate.

3-septate	16–40 × 3-6.........	Mostly 23–33 × 3·5-5·2.
5-septate	22-55 × 3·5–6.......	Mostly 26 42 × 3·8-5·6.
7-septate	35-56 × 3·7–6.......	Average 42 × 5·2.

The sclerotial stroma often breaks out in rough, cauliflower-like, stilboid bodies, which are up to 1 c.m high, and mostly dark brown in colour. Chlamydospores comparatively rare, intercalary, spherical, single, in chains or in clusters.

The ascus stage of *Fusarium sambucinum*, which has not been observed in South Africa, may be briefly characterised as follows :—

Gibberella pulicaris (Fr.) Sacc.

Saccardo, Michelia 1 : 43, 1877. Wollenweber, Fusarium-Monographie. 353–356, 1931 ; Fus. aut. del. 27-29. Wollenweber and Reinking, Die Fusarien, 76, 1935.
(For complete bibliography and synonymy, see Wollenweber, loc. cit.)

Perithecial spherical, 0·18 3 × 0·15 0·25 mm. (av. 0·26 × 0·24 mm.) diam., scattered or in groups, with bluntly conical apex ; later collapsing, umbilicate, verrucose, blue-black or yellow brown ; borne on a raised, round or elongated stroma of several millimetres extent. Asci club-shaped, 8- or 4-spored ; spores monostichous or more or less distichous, elongated-fusiform, straight or slightly curved, broadly rounded at both ends ; mostly 3-septate, less frequently 1-2- or 4-7-septate ; 3-septate spores 17–40 × 4–9, mostly 22–31 × 5·2–7.

The conidial form has been found in South Africa on several hosts :—

Hab. *Citrus sinensis* Osbeck, on fruit shewing stem end rot after 12 weeks in storage ; oranges from Sunday's River and Groot Drakenstein, Cape, and from White River, Zebediela and Rustenburg, Transvaal ; also from the air in the citrus packhouse, Zebediela, M.H. 28439.

Lycopersicum esculentum Mill., from rotting petioles of wilted plant, Gqaga, Transkei, M.H. 28421.

Lepidosaphes Gloveri; on mussel scale on citrus (associated with *Tetacrium rectisporum*) Chase Valley, Maritzburg, Natal (van der Plank) M.H. 28438.

Also isolated by du Plessis (13) from rotting potato tubers (*Solanum Tuberosum*) from Ceres, Cape.

This cosmopolitan species occurs as a saprophyte on decaying parts of plants. It may act as a weak parasite and cause fruit rot in stone fruits and cucurbits ; it also occurs on scale and other insects. The ascus stage has been found in Europe, America and Australia.

Growth on Standard Media.

Oat agar : Aerial mycelium scanty or moderate in amount, short, cobwebby. Growth in substratum venetian pink to deep rose pink, deepening to amaranth purple ; in the dryer parts of the medium, it may be amber yellow to mustard yellow. Pionnotes developed after 14 days, and were pale ochraceous salmon.

Hard potato agar : Aerial mycelium very sparse, white, cottony. Pionnotes developed in 7 to 14 days, and were light ochraceous salmon to ochraceous slamon.

Standard synthetic agar plus starch : Aerial mycelium sparse, short, cobwebby, white ; or absent. Growth in substratum deep rose pink to old rose and honey yellow in places ; the yellow colour disappeared after 4 weeks. Pionnotes light pinkish cinnamon to light ochraceous salmon, or taking up the colour of the stroma and becoming light coral red. In one tube, branched, erect, *Clavaria*-like sclerotial bodies developed at the base of the tube ; these were pale, and after some weeks, sporodochia developed on the tips of some of the branches.

Potato agar plus 5 *per cent. dextrose :* A moderate amount of aerial mycelium developed ; it was tomentose or cobwebby, white to deep pink or Indian lake and yellow ochre—the yellow colour chiefly in hyphae in contact with the glass. Growth in substratum amaranth purple, pomegranate purple and Bordeaux.

Potato plug : Aerial mycelium fairly vigorous, tomentose, white to deep rose pink. Growth on substratum pomegranate purple to Bordeaux. After some weeks, the growth sometimes became rather felt-like and wrinkled, and numerous flesh colour sporodochia developed.

Melilotus stem : Aerial mycelium vigorous, cobwebby to sericeo-tomentose, white, or tinged rose pink or naples yellow. Conidia were produced freely on the mycelium after 14 days, in mass light to pale ochraceous buff ; a few sporodochia developed after 8 weeks. In one set of cultures, there were groups of rugulose sclerotia after 8 weeks ; these were pale at first, becoming brown with age.

Bean pod : Pods covered with a moderate growth of mycelium, which is tomentose to sericeo-tomentose, white, or tinged coral pink to light coral red. Conidia forming freely in the mycelium were light ochraceous buff in mass.

Rice : Growth at first white and flesh pink, becoming olive ochre to honey yellow. After 8 weeks, the growth may still be yellow, or it may be deep vinaceous to wood brown, and the grains vandyke brown.

Measurements of Conidia.

Oat agar, culture 2 weeks old, conidia from pionnotes.

6-septate............	Rare................	37·5 × 4·7.
5-septate............	5 per cent........	32·5–45 × 4·4·5.
4-septate............	6 „	27·5–35 × 3·75–5.
3-septate............	88 „	20–40 × 3·4·4.
2-septate............	0·5 „	
1-septate....	0·5 „	

Melilotus stem, culture 2 weeks old, conidia from mycelium.

6–7-septate............	Rare................	50 × 5.
5-septate............	40 per cent..........	40–50 × 3·75–5.
4-septate............	21 „	22·5–45 × 3·75–5.
3-septate............	39 „	25–37·5 × 3·75 5.

Hard potato agar, culture 4 weeks old, conidia from sporodochia.

5-septate............	3 per cent..........	32·5–40 × 4·7 5.
4-septate............	4 „	27·5–32·5 × 4·7–5.
3-septate............	76 „	20–35 × 3·75–5.
2-septate............	12 „	
1-septate............	5 „	

Potato plug, culture 8 weeks old, conidia from sporodochia.

4-septate............	Few..................	27·5 × 5.
3-septate............	85 per cent...........	16–40 × 3·75–5.
2-septate............	7 ,,	
1-septate............	8 ,,	

Bean pod, culture 2 weeks old, conidia from pionnotes.

6-septate............	Few..................	47·5–54 × 5.
5-septate............	57 per cent...........	32·5–52·5 × 3·75–5.
4-septate............	11 ,, ...	27·5–35 × 3–3·75.
3-septate............	30 ,, ...	20–21·25 × 3–3·75.
1-septate............	2 ,,	

Fusarium sambucinum Fuck. f. 2. Wr.

Wollenweber, Fusarium-Monographie, 357, 1931; Fus. aut. del. 611, 942, 1145. Wollenweber and Reinking, Die Fusarien, 77, 1935.

Syn. *Fusarium subpallidum* v. *roseum* Sherb.

FIG. 16.

Fusarium sambucinum Fuck. *f.*2 Wr.; Conidia from sporodochia of 4 weeks old cultures on (*a*) oat agar, (*b*) bean pod, and (*c*) Melilotus stem, (*d*) chlamydospores from 4 weeks old culture on hard potato agar.

This variety is comparatively pale; aerial mycelium pale, yellowish or pink; stroma not carmine, pale or pinkish, does not become blue. Conidia in sporodochia or pionnotest pink to light orange-red or ochre in mass, and mostly 3-septate, 25 × 4·9, less frequently 4–5-septate; 5-septate conidia about 30 × 3.

Hab. *Citrus sinensis* Osbeck, from fruit shewing stem end rot after 18 weeks in storage; fruit from Groot Drakenstein, Cape, M.H. 28350 and 28357; Rustenburg, Transvaal, M.H. 28355; White River, Transvaal.

Lepidosaphes Gloveri, on mussel scale on *Citrus* (associated with *Tetacrium rectisporum*), Chase Valley, Maritzburg, Natal (van der Plank) M.H. 28415.

This variety has been found in Europe and North America, on diseased parts of plants of the genera *Citrus*, *Hordeum*, *Lycopersicum*, *Rubus* and *Solanum*; it is also found on mussel scale and in the soil.

Growth on Standard Media.

Oat agar : Aerial mycelium sparse or moderate in amount, fine, white, cottony. Growth in substratum colourless, or becoming tinged with congo pink near the base of the slant after 4 weeks. Small, scattered sclerotial bodies were tilleul buff, and became brownish. Sporodochia developed in 2 to 4 weeks; they were light ochraceous salmon.

Hard potato agar : Aerial mycelium white; it may be short and sparse, or vigorous, cottony. Growth on substratum colourless. Pionnotes and sporodochia developed in 2 to 4 weeks; they were light ochraceous salmon.

Standard synthetic agar plus starch : Aerial mycelium scant, fine, white, cottony, or absent. Growth in substratum colourless, or faintly pink; sometimes there was a tinge of brown near the base of the slant. The agar was often stained coral pink. Pionnotes and sporodochia, developing after 14 days, were light ochraceous salmon.

Potato agar plus 5 per cent. dextrose : Aerial mycelium copious or sparse, fine, white, cottony to tomentose. Growth in substratum avellanous, pale flesh colour, congo pink, or brownish vinaceous to deep brownish vinaceous; it sometimes became wrinkled and felt-like, and sometimes there were masses of brown plectenchyma at the base of the slant. A few scattered sporodochia sometimes developed.

Potato plug : Plug covered with a dense growth of fine, white, cottony mycelium; light brown, raised masses of plectenchyma (up to 4 mm. diameter) sometimes developed from the stroma. Sporodochia often numerous, crowded, light ochraceous buff to light ochraceous salmon.

Melilotus stem : Mycelium white, or tinged ochre, cottony to sericeo-tomentose, vigorous or sparse. Numerous sporodochia developed; they were 0·5 to 3 mm. in diameter, single or in groups, light ochraceous buff to light ochraceous salmon.

Bean pod : Aerial mycelium white, cottony to tomentose, vigorous or sparse. Small masses of brown plectenchyma sometimes developed between the medium and the glass. Large groups of sporodochia developed after 14 days; they were light ochraceous buff to ochraceous salmon.

Rice : Growth white to flesh colour; grains naples yellow. The pink colour faded with age, and the grains often became brown.

Measurements of Conidia.

A.—Strain from oranges.

Oat agar, culture 2 weeks old, conidia from sporodochia :—

5-septate	Few	35 × 5.
4-septate	1 per cent	30–32·5 × 3·75–4·4.
3-septate	96 ,,	20–37·5 × 2·8–4·7.
2-septate	3 ,,	

Melilotus stem, culture 2 weeks old, conidia from sporodochia.

3-septate	99 per cent	20–35 × 3·75.
2-septate	1 ,,	

Bean pod, culture 2 weeks old, conidia from sporodochia.

4-septate	3 per cent	32·5–42·5 × 3·75.
3-septate	96 ,,	22·5–45 × 2·8–4·4.
1-septate	1 ,,	

B.—Strain from mussel scale.

Oat agar, culture 4 weeks old, conidia from sporodochia :—

5-septate	86 per cent	25–42·5 × 4·7–5.
4-septate	11 ,,	22·5–32·5 × 3·7–5.
3-septate	3 ,,	17·5–40 × 4·7–5.

Hard potato agar, culture 4 weeks old, conidia from sporodochia.

5-septate............	23 per cent..........	25–32·5 × 3·75–5.
4-septate............	64 „	22·5–30 × 3·75–4·7.
3-septate............	13 „	18·75–30 × 3·75–4·7.

In cultures of the strain from mussel scale, 5-septate conidia were more frequent, and the conidia, on the whole, stouter than in cultures of this variety from oranges.

Fusarium sambucinum Fuck. **f. 6** Wr.

Wollenweber, Fusarium-Monographie, 358, 1931 ; Fus. aut. del. 327–329. Wollenweber and Reinking, Die Fusarien, 78, 1935.

Syn. *Fusarium sulphureum* Schlecht.

F. discolor App. et Wr. v. *sulphureum* (Schl.) App. et Wr.

F. generense Daszewska.

This variety is distinguished by the sulphur yellow colour of the plectenchymatous part of the stroma and the aerial mycelium, and the absence of the carmine colouring found in the species and the other varieties. Spherical, dark blue sclerotia may be present or wanting. Conidia in sporodochia and pionnotes, light orange in mass. Sclerotial plectenchyma light brown to sepia. Chlamydospores intercalary, conidia 3–5-septate ; 3-septate 28 × 4·5 ; 5-septate 38 × 5·1.

This form was not observed in the Union, but is recorded by Wollenweber (loc. cit.) as occurring in South West Africa on the red locust, *Nomadacris septemfasciata*.

Form 6 is cosmopolitan, and occurs on a large number of plants, and also on mushrooms, in soil, etc. It causes a tuber rot of potatoes.

Fusarium culmorum (W. G. Sm.) Sacc.

Saccardo, Syll. Fung. 11, 651, 1895. Wollenweber, Fusarium-Monographie, 360, 1931 ; Fus. aut. del. 330-337, 613, 943-945, 1147–1149. Wollenweber and Reinking, Die Fusarien, 79–81, 1935.

Syn. *Fusisporium culmorum* W. G. Sm. ; *Fusarium culmorum* (W. G. Sm.) Sacc. *f. 1.* Wr.

Fusarium culmorum (W. G. Sm.) Sacc. v. *leteius* (*-lethaeum*) Sherb.

F. culmorum (W. G. Sm.) Sacc. v. *majus* Wr. (nom. nud.).

F. heidelbergense Sacc. ; *F. mucronatum* Fautr. in herb. pr. p.

F. neglectum Jacz. ; *F. roseum* Lk. v. *rhei* Karst.

F. rubiginosum App. et Wr. ; *F. sambucinum* Fuck. *f. 3.* Wr.

F. Schribauxii Del. ; *Fusoma tenue* Grove.

Fusarium versicolor Sacc.

Conidia at first scattered in the aerial mycelium, free or in false heads, later sometime forming a pionnotal layer, or covering the tubercularia-like sporodochia. Conidia in mas varied in colour, yellow, pink, later ochre to coffee brown, often becoming more or less tinged with the colour of the stroma. Stroma purple-red and golden yellow to ochre brown. Conidia fusiform-falcate, gradually or abruptly attenuate at both ends ; apical cell sometimes rostrate, constricted like the neck of a bottle ; base pedicellate ; wall thick, highly refractive, often brownish ; septations distinct. Conidia 5-septate, less frequently 3-4- or 6–8-septate ; exceptionally less than 3-septate.

3-septate..............	19–40 × 4–7·6, ...mostly	24–32 × 4·8–7.
5-septate..............	23–74 × 4–8·8, ...mostly	30–60 × 4·8–7·5.
7-septate..............	36–75 × 4–9, ...mostly	42–54 × 5–8.

Chlamydospores more frequently intercalary than terminal, spherical or oval, occurring in conidia as well as in the mycelium, single, 2-celled, or in chains and clusters, brown in mass, 1-celled 9–14 μ diam., 2-celled 13–27 × 7–19 μ.

Hab. *Lolium temulentum* L., from stems of plants affected with foot rot (ass. *Helminthosporium* Sp.), Waaikraal, Pretoria dist. (Wager).

Sorghum vulgare Pers. v. *caffrorum* (Thun.) Hubb. et Rehder, forming a pink incrustation on heads of kaffir corn infected with smut, (*Sphacelotheca sorghi*), Ixopo, Natal, May 1923 (Storey) M. H. 17272.

Triticum sp., from stems of plants affected with foot rot, (ass. *Helminthosporium* sp.), Waaikraal, Pretoria dist., (Wager).

This species, which is widely distributed, is injurious to cereals, and may cause a rot of stored fruits. It occurs on numerous genera of plants, in the soil, in the air, and on other fungi.

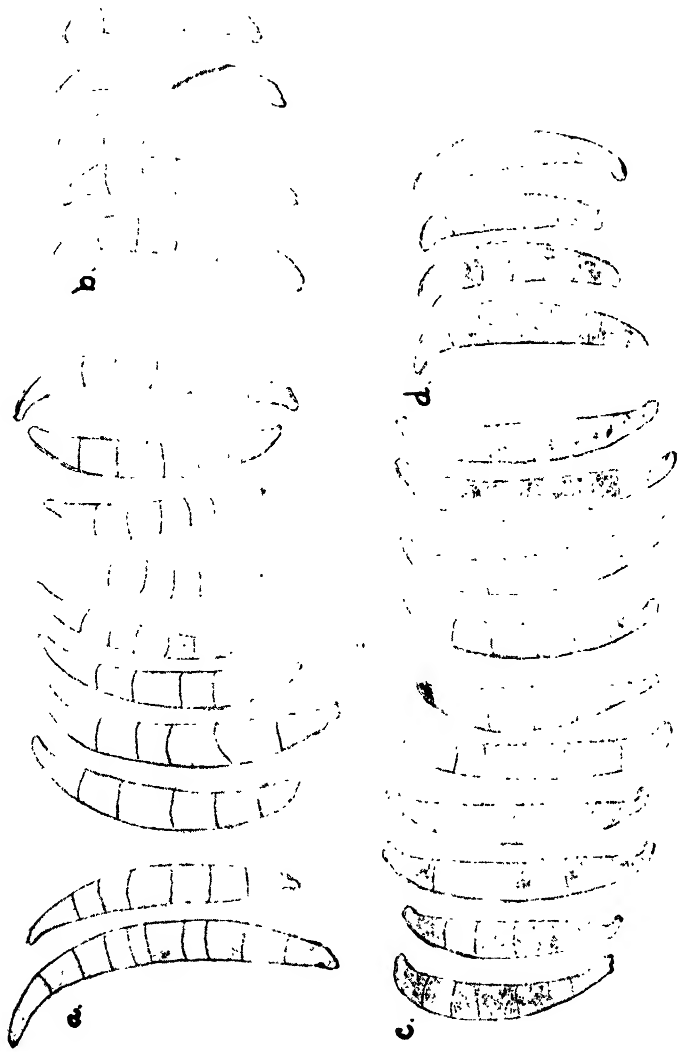

FIG. 17.

Fusarium culmorum (W. G. Sm.) Sacc.; conidia from (*a*) pink incrustation on *Sorghum* (M.H. 17272), (*b*) pionnotes of 4 weeks old culture on bean pod; from mycelium of 2 weeks old cultures of (*c*) standard synthetic agar plus starch and (*d*) on potato agar.

Growth on standard media.

Oat agar: Aerial mycelium copious, cottony, white to ochraceous buff and honey yellow, or tinged pink. Growth on substratum carmine to ox-blood red. A few large sporodochia developed after 4 weeks; they were light ochraceous salmon.

Hard potato agar : Aerial mycelium scant, white, tufted. Growth in substratum colourless ; after 14 days, the slant was covered with a thin pionnotal layer, which was light ochraceous salmon to vinaceous cinnamon. A few small sporodochia were ochracous salmon to orange cinnamon.

Standard synthetic agar plus starch : Aerial mycelium scant to moderate in amount white. Growth on substratum tyrian rose to pomegranate purple, carmine and ox-blood red. Numerous small sporodochia and pionnotes were light ochraceous salmon and salmon buff to vinaceous cinnamon.

Potato agar plus 5 per cent. dextrose : Aerial mycelium at first white, then white to chamois colour at the top of the slant, below stained begonia rose. Growth on substratum carmine to ox-blood red. Spore masses were tinged with the red colour of the stroma.

Potato plug : Aerial mycelium copious, rather coarse, cobwebby, white to naples yelow and rose pink. Growth on substratum eugenia red to ox-blood red.

Melilotus stem : Stems covered with a vigorous growth, white at the top where the mycelium filled the tube ; below clothing the stems with a growth chatenay pink to spinal red in colour. Sporodochia not numerous, light ochraceous salmon.

Bean pod : Growth extremely vigorous, the whole tube being filled with mycelium which was white to geranium pink. Extensive pionnotes developed, which were at first ochraceous salmon and later vinaceous cinnamon.

Rice : Aerial mycelium copious, at first white to amber yellow, later becoming white to ochre red. Growth on substratum alizarine pink to acajou red, becoming pompeian red to madder brown.

Measurements of conidia.

Standard synthetic agar plus starch, culture 14 days old, conidia from sporodochia.

7-septate............	4 per cent........	42·5–45 × 5–6·3.
6-septate............	2 ,, ...	40–42·5 × 6–6·3.
5-septate............	86 ,, ...	30–47 × 5 7.
4-septate............	6·5 ,, ...	28–35 × 5–7.
3-septate............	1·5 ,, ...	27–36 × 4–5.

Oat agar, culture 4 weeks old, conidia from sporodochia.

6-septate............	3 per cent..........	45–50 × 5–6.
5-septate............	59 ,, ...	37·5–53 × 5–6.
4-septate............	21 ,, ...	35–52·5 × 5–6.
3-septate............	17 ,, ...	30–37·5 × 5.

Melilotus stem, culture 16 days old, conidia from sporodochia.

7-septate............	0·5 per cent........	45 × 6.
6-septate............	3·5 ,, ...	40–45 × 5·5–6·3.
5-septate............	64 ,, ...	30–45 × 5–6·3.
4-septate............	16 ,, ...	27·5–37·5 × 5–6·3.
3-septate............	16 ,, ...	20–35 × 5–6·3.

From pionnotes occurring in nature on ovaries of *Sorghum*, M. H. 17272.

9-septate............	Rare................	55 × 6·3.
7-septate............	1·5 per cent........	40–45 × 6.
6-septate............	6·5 ,, ...	40–47·5 × 6–6·3.
5-septate............	79 ,, ...	35–45 × 5–6·3.
4-septate............	6·5 ,, ...	27·5–35 × 5–6.
3-septate............	6·5 ,, ...	27·5–32·5 × 4–6.

Fusarium graminearum Schwabe.

Schwabe, Fl. Anhaltina, 2 : 285, 1838. Wollenweber, Fusarium-Monographie, 363, 1931 ; Fus. aut del. 338, 339, 354–357, 948. Wollenweber and Reinking, Die Fusarien, 82–83, 1935.

Syn. *Fusarium graminearum* Schw. v. *caricis* (Oud.) Wr.

F. caricis Oud. ; *Pionnotes flavicans* Sacc. et D. Sacc.

?*Selenosporium bufonicola* Speg.; *Fusarium bufonicola* (Speg.) Sacc. et Trott.
Fusarium discolor App. et Wr. v. *majus* Wr. *apud* Lewis (nom. nud.).
F. fimicolum Tassi; *F. gynerii* Cke. et Hark.
F. Mollerianum Thuem.; *F. insidiosum* (Berk.) Sacc.
?*F. rhoicolum* Fautr.; *F. roseum* Lk. pr. p.; *Fusidium roseum* Lk. pr. p.
F. roseum Lk. v. *maydis* Sacc.; ?*F. roseum* Lk. v. *cucubali-bacciferi* Sacc.
F. rostratum App. et Wr. (non Speg.) *F. stictoides* Dur. et Mont.

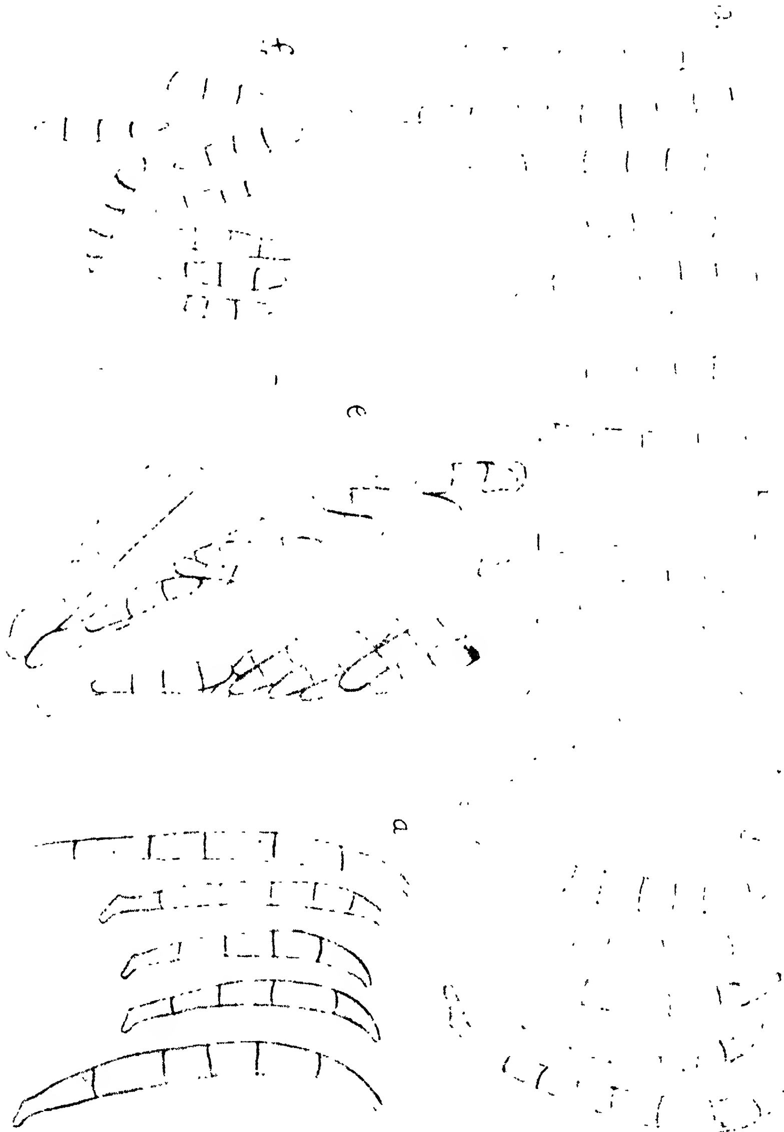

FIG. 18.

Fusarium gramineaerum Schwabe; conidia from mycelium of culture on (*a*) oat agar, 4 weeks old, (*b* and *d*) potato plug, 7 weeks old, (*c*) standard synthetic agar plus starch, 5 weeks old, (*e-f*) *Gibberella Saubinetii* (Mont.) Sacc., (*e*) asci and (*f*) sporidia.

Aerial mycelium floccose, white or tinged with pink or yellow. Stroma varied in colour, white to pink, golden yellow, ochre, or carmine to purple red; it is partly plectenchymatous, effuse, more or less covered with floccose mycelium, and partly sclerotially erumpent and clothed with conidial masses. These are less frequently sporodochial than pionnotal, and are ochre to light orange red. Conidia sometimes compact, as in *F. culmorum*, sometimes more elongated, fusiform-falcate, curved, tapering at both ends; apex conical or constricted; base pedicellate. Conidia 3-5-septate, less frequently 1–2- or 6–9-septate.

3-septate..............	25–66 × 3–6 ....mostly	30–47 × 3·3–5.
5-septate..............	28–72 × 3·2–6 ......mostly	41–60 × 4·3–5·5.
7-septate..............	50–88 × 4–7 ....mostly	61–82 × 4·5–6·5.
9-septate..............	55–106 × 4–8 ....mostly	61–96 × 4·5–7.

Chlamydospores wanting or scarce, intercalary.

Hab. *Zea Mays* L., on grain and cob, (grain germinating on the cob), L'Orange, Louis Trichardt, N. Transvaal, Oct. 1932 (Leemann) M.H. 28442 and 26582; on grain and cob showing moulding and pink discolouration, Rustenburg, Aug. 1929 (Watts) M.H. 24866; from maize meal, Bethal, O.F.S.; from grain (which frequently showed no sign of disease), Kenya, 1930 (Macdonald).

The conidial stage was also isolated from maize stalks on which *Gibberella* fructifications had developed.

Fusarium graminearum is cosmopolitan and it occurs chiefly on cereals, to which it is injurious, causing foot rot and seedling blight; it also causes cob mould of maize. It is the conidial form of:—

Gibberella Saubinetii (Mont.) Sacc. pr. p.

(For synonymy and bibliography, see Wollenweber loc. cit.)

Perithecia blue-black, solitary or in groups, verrucose or smooth, ovoid or spherical, coriaceo-membranaceous, frequently crowned at the apex with a long-celled outgrowth of the peridium, 0·20 × 0·17 (0·15 0·3 × 0·1–0·25) mm. (Plate II b.) Ascus 8-spored, 37–84 × 8–15, club-shaped. Spores monostichous or imperfectly distichous, fusiform, slightly curved or almost straight, broadly conical to acute at both ends, 3-septate, 16–33 × 3–6, mostly 18–27 × 3·4–5, less frequently 1-septate, 14–24 × 2·5-5, exceptionally 4-septate.

Hab. *Zea Mays*, on stalks, Kenya, March 1930 (MacDonald) M.H. 25348; Hopevale, nr. Donnybrook, Natal, Jan. 1935 (Doidge) M.H. 27723.

Growth on Standard Media.

Oat agar: Aerial mycelium fairly abundant, tufted, cottony, white to yellow ochre and rose colour. Growth on substratum pomegranate purple to Bordeaux. After 4 weeks, the ochre colour disappeared. No spore masses were observed.

Hard potato agar: Aerial mycelium fairly well developed, or scant, cottony, white to rose pink. Growth in substratum colourless, or with a tinge of Bordeaux.

Standard synthetic agar plus starch: Aerial mycelium scanty, white to yellow ochre. Growth in substratum eugenia red to carmine.

Potato agar plus 5 per cent. dextrose: Slant covered with a fairly vigorous mycelial growth, which was floccose, white to rose colour or yellow ochre. Growth in substratum pomegranate purple to Bordeaux. The ochre colour disappeared with age.

Potato plug: Plug covered with a cottony, tufted mycelium, which is often very vigorous. It is white to rose pink and ochre. Growth in substratum carmine, pomegranate purple, Bordeaux or ox-blood red.

Melilotus stem: Stems covered with a vigorous mycelial growth, which was cottony at first, and white to rose pink or ochre; later the colour in some tubes deepened to carmine, and the yellow colour faded.

Bean pod : Aerial mycelium vigorous, covering pods, at first white to rose colour and yellow ochre. Later the growth was white to Bordeaux, and the yellow colour had faded.

Rice : Aerial mycelium white to naples yellow and yellow ochre ; growth on grains honey yellow, or carmine to ox-blood red. In 4–6 weeks the colour faded, and growth was cinnamon buff to snuff brown.

Measurements of conidia.

Hard potato agar, culture 4 weeks old, conidia from mycelium.		
6–7-septate	Few	52·5–62·5 × 5.
5-septate	59 ,,	37·5–65 × 4·4–5.
4-septate	22 per cent	30–57·5 × 3 5.
3-septate	19 ,,	22·5 47·5 × 3 5.
Oat agar, culture 4 weeks old, conidia from mycelium.		
8-septate	2 per cent	67·5 89 × 4·4–5.
7-septate	2 ,,	70 89 × 3·75–5.
6-septate	10 ,,	57·5–72·5 × 4–4·7.
5-septate	36 ,,	40–65 × 4 4·7.
4-septate	13 ,,	37·5 50 × 3 4·4.
3-septate	25 ,,	22·5–42·5 × 3–3·75.
2-septate	2 ,,	
1-septate	10 ,,	
Standard synthetic agar plus starch, culture 3 months old, conidia from mycelium.		
7–8-septate	Rare	50 65 × 4·7 5·5.
6-septate	1 per cent	45–65 × 4–5·5.
5-septate	61 ,,	30 54 × 4·4–5.
4-septate	36 ,,	30–42·5 × 3·7–4·7.
3-septate	2 ,,	20–45 × 3·75–5.

Section LATERITIUM.

Wollenweber, Ann. myc. 15 : 2 and 54, 1917 ; Fusarium-Monographie, 368–370, 1931. Wollenweber and Reinking, Die Fusarien, 86–88, 1935.

Mycelium white, pink, yellow, orange, violet to blue-black. Stroma pale or carmine to ochre, green olive, brown or blue-black. Spherical sclerotia dark blue or pale. Microconidia 0–1- or more septate, rare, usually small, ellipsoid or comma-shaped, or large, thick-walled, ovoid to pyriform, disappearing with the formation of sporodochia and pionnotes. Macroconidia long, cylindrical, fusiform to lanceolate, almost straight to falcate, constricted at the apex, and more curved near the apex than in the middle, base pedicellate. Macroconidia pink, and orange to brick red in mass, sometimes becoming darker through absorption of the colour of the stroma, or becoming lighter if dry and powdery. Terminal chlamydospores wanting ; intercalary chlamydospores occur more or less frequently in conidia and mycelium.

Key to the South African Species.

A.—Conidia in sporodochia and pionnotes 3–5-septate........ *F. lateritium.*
AA.—Conidia in sporodochia and pionnotes 5-septate :
B.—Stroma not carmine to ochre.................... *F. lateritium* v. *longum.*
BB.—Stroma carmine to ochre........................ *F. stilboides.*

Fusarium lateritium Nees.

Nees, System d. Pilze u. Schwamme, 31, 1817. Wollenweber, Fusarium-Monographie, 370–375 1931 ; Fus. aut. del. 226, 228–276, 281–285, 570, 577–581, 583–587, 592, 955–957, 959–961, 1154. Wollenweber and Reinking, Die Fusarien, 88–91, 1935.

Syn. *Fusarium lateritium* Nees *f.* 1. Wr., and v. *pallens* Wr.
F. lateritium Nees v. *fructigenum* Wr. and *f.* 1 *and f.* 2 *Wr.*
F. lateritium Nees v. *tenue* Wr.; *F. acaciae* Cke. et Harkn.
F. fructigenum Fr.; *F. limonis* (Briosi) Penz.
(For complete bibliography and very extensive synonymy, see Wollenweber, loc. cit.).

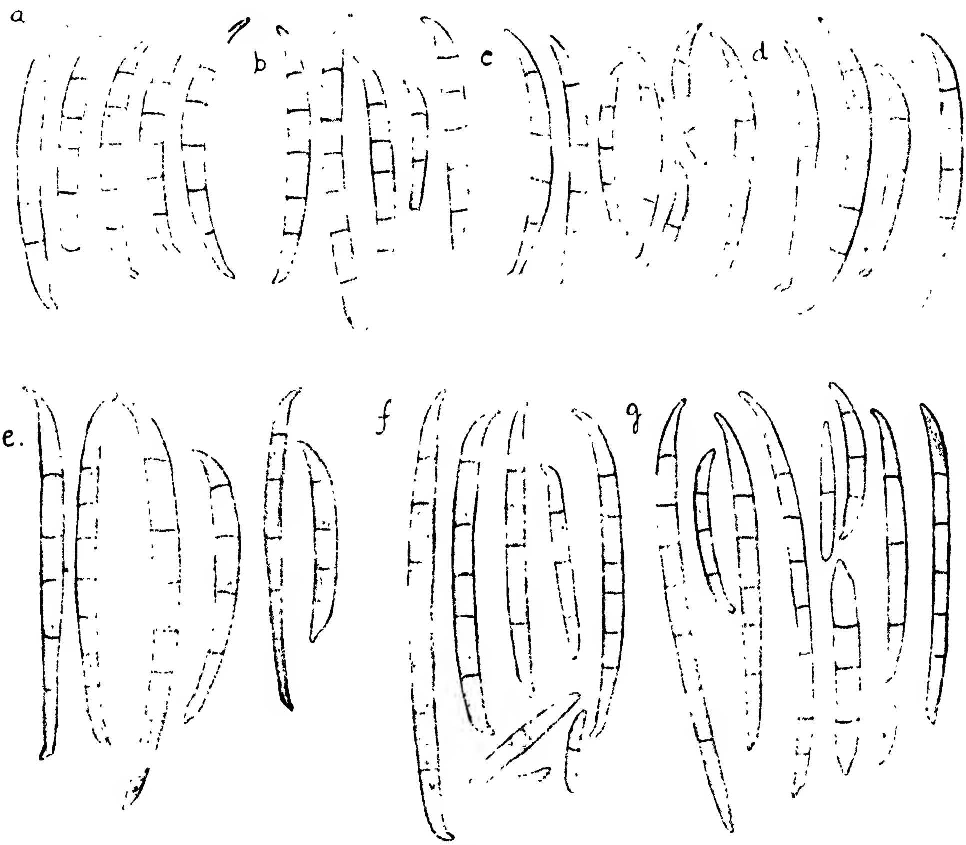

FIG. 19.

Fusarium lateritium Nees; (*a-d*) strain from failing citrus buds, (*e-g*) from citrus twig; conidia from pionnotes of (*a*) 5 weeks old culture on Melilotus stem, (*b*) 10 weeks old culture on potato plug, (*c*) 2 weeks old culture on oat agar; conidia from (*d*) pionnotes of 8 weeks old culture on synthetic agar plus starch, (*e*) mycelium on bean pod, culture 4 weeks old; pionnotes of 4 weeks old culture on (*f*) standard synthetic agar plus starch and (*g*) oat agar.

Stroma fleshy, erumpent, smooth, convex; or cartilaginous, sclerotial, plectenchymatous rough (cauliflower-like); or erect and branched: pale pink, yellow, orange, or chestnut brown to dark blue; sometimes with spherical sclerotia, which are dark blue to pale. Aerial mycelium pale, pink or yellow, or tinged with the colour of the plectenchymatous stroma. Conidia at first scattered in the mycelium; later sporodochia develop, singly or in groups; they often coalesce to form a continuous pionnotal layer. Conidia in mass brick red to orange, golden yellow, pink, or salmon colour. Conidia 3-5-septate, rarely with fewer or more septations, thin-walled, long, fusiform-falcate, almost cylindrical, or slightly dorsiventral in the middle, definitely curved and often abruptly bent near the apex; apex constricted, sometimes rostrate; base typically pedicellate.

0-septate............	7 11 × 2·5–3·5......	Average 7·8 × 2·8.
1-septate............	11–35 × 2–5.........	Mostly 13–30 × 2·4 4·5.
3-septate............	13 52 × 2 5.........	Mostly 2 1-42 × 2·5 4·4.
5-septate............	24-84 × 2·5-5.......	Mostly30–59 × 3·2–4·7.
7-septate............	32–84 × 3–5.........	Mostly 49-72 × 3·3–4·5.

Chlamydospores rare, intercalary, in conidia and mycelium. Sclerotial plectenchyma up to 5 mm. thick, blue, brownish or colourless.

The ascus stage which has not been observed in South Africa is :—

Gibberella baccata (Wallr.) Sacc.

(For extensive bibliography and synonymy, see Wollenweber loc. cit.).

Perithecia often interspersed with the sporodochia of the conidial stage, or in groups, blue-black, obovate to spherical, rugulose, papillate at the apex, with an inconspicuous ostiole and a delicate plectenchymatous wall, 0·2 0·3 × 0·15–0·22 mm. Asci 8-spored, seldom 4-spored, club-shaped, delicate, pedicellate, paraphysate. Spores hyaline, smooth, oblong-ovoid or fusiform, broadly conical at both ends, sometimes sub-dorsiventral, 3 (1–3) -septate ; 3-septate spores 12–30 × 4- 10, mostly 13–25 × 4·7–8 μ.

The ascus stage has been found on a number of hosts in Europe, America, Asia and Australia. The conidial stage is cosmopolitan, occurring chiefly in the temperate zone on a large number of hosts ; it is a cause of bud rot, fruit rot and die back of twigs. It has been found on *Citrus* and several other hosts in South Africa.

Hab. *Carica papaya* L., on decaying pawpaw fruit (a secondary form of decay associated with *Gloeosporium* sp.) Bokfontein, Pretoria Dist., M.H. 28429.

Citrus limonia Osbeck, from stem end rot of lemon, developing after 18 weeks in storage ; fruit from Rustenburg, Transvaal.

Citrus sinensis Osbeck, from fruit (75 strains studied), common in fruit shewing stem end rot (78 per cent.) and navel end rot or lateral lesions after 6 7, or 12–18 weeks in storage, 1933–34 ; in navel oranges from Muden, Natal, from Rustenburg, White River, Letaba and Zebediela, Transvaal, and from Sunday's River, Cape ; from tough, dry form of rot on side of navel orange from Zebediela, 1931, M.H. 28395.

From twigs showing die-back, Hankey, Cape, May 1930 (van der Plank) M.H. 28423 ; Ofcalaco, N. Transvaal, July 1930 (van der Plank).

From bark, scaling off orange trees after prolonged drought, De Wildt, Pretoria Dist., March 1934 (Doidge) ; on bark cracking and gumming, probably as a result of root injury, Elandshoek, E. Transvaal (Simmonds) ; on bark of tree affected by scaly bark, Mazoe Estates, S. Rhodesia (Bates).

On buds in nursery stock, failing under wet conditions, White River, E. Transvaal, Nov. 1929 (Esselen).

Euphorbia crassipes Marloth, on rotting stem of succulent *Euphorbia*, Willeston, Cape, M.H. 28378 and 28391.

Prunus persica Sieb. et Zucc., on decaying fruit, Orchard Siding, Cape, Feb. 1913 (Dicey) M.H. 5637.

Lepidosaphes Gloveri (associated with *Tetacrium rectisporium*) on mussel scale on *Citrus* twigs, Case Valley, Maritzburg, Natal (van der Plank) M.H. 28391.

Ceroplastis sp., from large waxy scale, on twigs of Acacia sp., Grahamstown, Cape (Smith) M.H. 28443.

Growth on Standard Media.

Oat agar : Aerial mycelium very sparse, fine, white, cottony. Growth in substratum at first colourless to barium yellow ; later it often became olive ochre to brown, or, especially near the base of the slant, dark delft blue and sclerotially erumpent. In some cultures there were a few small, dark blue, spherical sclerotia. Pionnotes developed freely ; they were pale flesh colour to light ochraceous salmon, later becoming flesh ochre to rufous.

Hard potato agar : Aerial mycelium sparse, short, white, sometimes becoming mealy-looking, when conidia are formed in minute masses. Growth in substratum colourless, or with a faint touch of pink. Numerous minute sporodochia rapidly coalesced to form a continuous pionnotal layer, which was at first pale flesh colour to light ochraceous salmon, then bittersweet orange ; the last named colour soon faded to flesh ochre.

Standard synthetic agar plus starch : Aerial mycelium sparse to moderate in amount, white, cobwebby. Growth in substratum at first colourless, remaining pale and becoming raised and gelatinous, or becoming deep delft blue and sclerotially erumpent near the base of the slant. Pionnotes developed freely and were light ochraceous salmon to bittersweet pink.

Potato agar plus 5 per cent. dextrose : Aerial mycelium wanting, sparse, or moderate in amount, cottony or tomentose, white tinged naphthalene yellow and buff pink, sometimes becoming deep olive buff. Growth on substratum at first pale to flesh pink and pinkish cinnamon, raised and somewhat gelatinous in places ; the stroma remained pale, or became light brownish olive to snuff brown, bister, or slate colour to blue-black. The medium sometimes became stained brown or black. Pionnotes developed freely, and were ochraceous salmon, bittersweet pink to grenadine pink and flesh ochre.

Potato plug : Plug usually covered with a moderate amount of aerial mycelium ; this was fine, cottony to felt-like or sericeo-tomentose, sometimes becoming mealy where conidia developed, white to cream buff and olive ochre. Pionnotes usually developed, and were ochraceous salmon to flesh ochre. Small sclerotia developed in some tubes.

Melilotus stem : Mycelium scanty or fairly, abundant, cottony to sericeo-tomentose, white to naphthalene yellow and ochre. Sporodochia developed : they were flesh colour to flesh ochre. In some strains, groups of small blue-black sclerotia developed.

Bean pod : Pods covered with a moderate growth of white mycelium, which was cottony to sericeo-tomentose, or with a tough, leathery, wrinkled growth, tilleul buff in colour. Pionnotes and sporodochia usually developed : they were flesh colour, salmon, bittersweet pink and salmon buff.

Rice : Growth white to flesh colour and grenadine pink to carrot red ; it may be naples yellow to mustard yellow in places. The colour may fade with age. Spore masses developed in some tubes.

Measurements of Conidia.

Bean pod, strain from *Citrus* twig, culture 4 weeks old, conidia from pionnotes.

8-septate............	1 per cent........	82·5 × 3·75.
6-septate............	2·5 „	57·5–70 × 3–3·75.
5-septate............	18 „	50–67·5 × 3–3·75.
4-septate............	11 „	50–65 × 3·75.
3-septate............	50·5 „	27·5–50 × 2·5–3·5.
1-septate............	18 „	

Bean, strain from pawpaw fruit, culture 2 weeks old, conidia from pionnotes.

6-septate............	0·5 per cent.	
5-septate............	75 „	35–47·5 × 3·7–4·5.
4-septate............	8 „	32·5–40 × 3·7–4.
3-septate............	15 „	22·5–35 × 3–4.
0–1-septate............	1·5 „	

Bean, strain from *Euphorbia* stem, culture 2 weeks old, conidia from pionnotes

8-septate............	Few................	65 × 3·75.
6-septate............	10 per cent..........	42·5–65 × 3·7–4·7.
5-septate............	67 „	42·5–65 × 3·7–4·7.
4-septate............	12 „	42·5–50 × 3·7–4.
3-septate............	8 „	22·5–40 × 3–3.75.
1-septate............	3 „	

Hard potato agar, strain from *Citrus* twig, culture 4 weeks old, conidia from pionnotes.

7-septate............	1	per cent........	62·5–67·5 × 3·75.
6-septate............	3·5	,, ...	60–67·5 × 3–3·75.
5-septate............	22	,, ...	52·5–72·5 × 2·5–3·75.
4-septate............	36	,, ...	50–62·5 × 3–3·5.
3-septate............	25	,, ...	30–45 × 3–3·5.
2-septate............	1·5	,,	
1-septate............	9	,, ...	17·5–22·5 × 2–3.
0-septate............	4	,,	

Fusarium lateritium Nees var. **longum** Wr.

Wollenweber, Fusarium-Monographie, 385, 1931; Fus. aut. del. 964, 965. Wollenweber and Roinking, Die Fusarien, 93, 1935.

Syn. *Fusarium lateritium* Nees v. *longum f.* 1 Wr.

Microcera mytilaspidis McAlp.

? *Fusarium longisporum* Cke. et Mass.

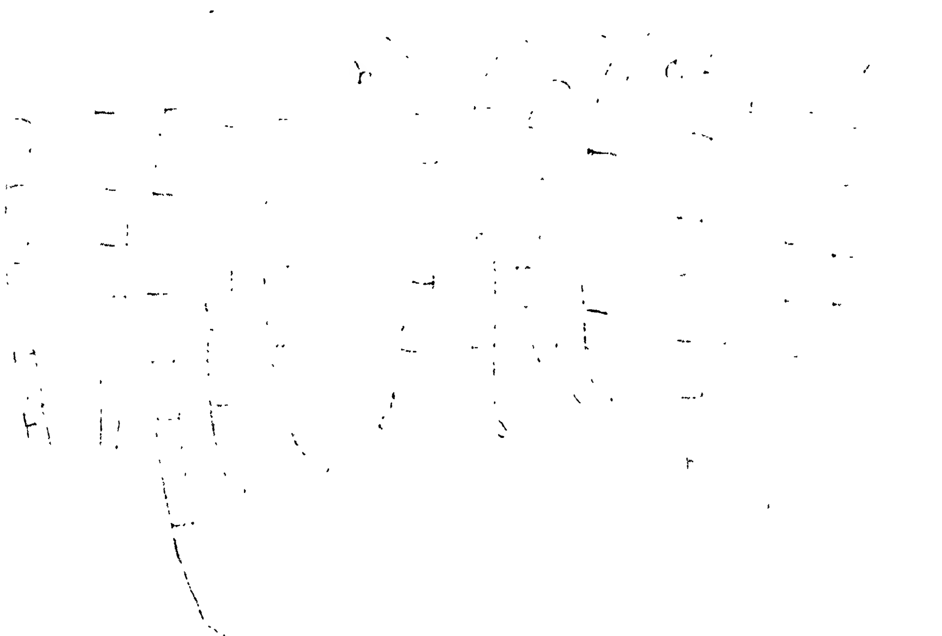

Fig. 20.

Fusarium lateritium Nees. v. *longum* Wr.; conidia from (*a*) sporodochia of 5 weeks old culture on standard synthetic agar plus starch, and (*b*) sporodochia of 2 weeks old culture on bean pod.

The conidia are long, cylindrical, tapering at both ends, constricted at the apex, pedicellate at the base; in sporodochial and pionnotal masses they are orange red. In the aerial mycelium, there are a few, small, scattered, 0–1-septate forms, but conidia are mostly 5-septate, less frequently 3–4- or 6–7-septate, exceptionally 9-septate.

0-septate............	8–16 × 2–3·3.......	Average 9 × 2·5.
1-septate............	9–20 × 2·5–3·5.....	Average 13 × 3.
3-septate............	19–54 × 3–4·2.......	Average 42 × 3·7.
5-septate............	45–80 × 3·5–5·5.....	Mostly 52–69 × 3·9–4·9.
7-septate............	56–90 × 4–6.........	Mostly 67–77 × 4·2–5·2.
9-septate............	80–94 × 4·5–6.......	Average 84 × 4·5.

Stroma pale or flecked with blue; small sclerotia occur more or less frequently, and are spherical, dark blue or pale.
Hab. *Citrus limonia* Osbeck, on lemons kept 7 weeks in storage; fruit from Sunday's River, Cape.

Citrus sinensis Osbeck, from stem end rot in navel oranges, after 18 weeks in storage (5 isolations); fruit from Sunday's River, Cape.

From bark of orange tree, cracking and gumming above union, on trees of which roots were water-logged, Letaba, N. Transvaal, 1931, M.H. 28417.

Coffea arabica L., on berries, from Lemana, N. Transvaal, Jan. 1930 (Watson).

This variety has been found on trees, often associated with scale insects, or with other fungi such as *Nectria coccophila* and *Meliola* spp., in tropical and sub-tropical regions of America, Asia and Australia, rarely in Europe.

Growth on Standard Media.

Oat agar: Aerial mycelium moderate to sparse, short, tomentose, white or tinged salmon buff. Growth in substratum colourless. Groups of sporodochia and pionnotes developed freely after 2 weeks; they were pale ochraceous salmon to flesh colour, fading after 8 weeks to light vinaceous cinnamon.

Hard potato agar: Slant covered with a moderate amount of mycelium, which was usually short, cottony to tomentose, white or tinged salmon colour. Growth in substratum colourless. Pionnotes and sporodochia formed after 14 days; they were salmon colour.

Standard synthetic agar plus starch: Aerial mycelium sparse, white, or none. Growth in substratum colourless, or with a tinge of deep brownish vinaceous at the top of the slant Pionnotes and sporodochia developed freely after 14 days; they were pale ochraceous salmon to flesh colour, fading with age to light vinaceous salmon. In one strain, a few small, blue-black sclerotia were present after 3 months.

Potato agar plus 5 per cent. dextrose: Aerial mycelium wanting, or short, white tomentose. Growth in substratum colourless, or white to grenadine pink, fading to salmon colour, and, after 30 days, to vandyke brown. In one strain, a few minute, deep delft blue sclerotia developed near the base of the slant.

Potato plug: Growth rather slow; mycelium fine, short, compact, white or tinged salmon buff. In one strain, after 4 weeks, there were patches of bluish green in the substratum. Spore masses formed between the medium and the glass; in cultures 8 weeks old, they were light vinaceous cinnamon.

Melilotus stem: Growth slow; mycelium sparse, tomentose, white or tinged ochre in places. Small sporodochia developed; they were at first pale ochraceous salmon, fading after 8 weeks to light pinkish cinnamon.

Bean pod: Aerial mycelium developed more rapidly than on melilotus stems; it was cottony to tomentose, and white or tinged salmon buff in places. Sporodochia and pionnotes developed after 14 days; they were pale ochraceous salmon to salmon colour.

Rice: Growth slow; mycelium at first white, seashell pink and naples yellow. In some cases the growth remained pale, in others it became flesh colour to carrot red, and ater wood brown. In some tubes fairly numerous, small, flesh colour sporodochia developed.

Measurements of Conidia.

Oat agar, culture 2 weeks old, conidia from sporodochia.

7-septate............	0·5 per cent......	90 × 6.
6-septate............	4·5 ,, ...	75–95 × 4·5–6, mostly 5 μ wide.
5-septate............	94 ,, ...	60–87·5 × 4·5–6, mostly 5 μ wide.
4-septate............	1 ,,	
3-septate............	Few...............	45–50 × 4–4·5.

Standard synthetic agar plus starch, culture 2 weeks old, conidia from pionnotes.

8-septate............	0·5 per cent......	67–85 × 5·5.
7-septate............	9 ,, ...	50–80 × 5–5·5.
6-septate............	8 ,, ...	67–82·5 × 5–5·5.
5-septate............	81 ,, ...	50 80 × 4 5·5.
4-septate............	1 ,, ...	40 45 × 4 4·5.
3-septate............	0·5 ,, ...	30–42·5 × 4 4·5.

Standard synthetic agar plus starch, culture 5 weeks old, conidia from pionnotes.

8-septate............	1·5 per cent......	97·5–105 × 5 5·5.
7-septate............	21 ,, ...	90–112·5 × 4 5·5.
6-septate............	30 ,, ...	87·5–107·5 × 4–5·5.
5-septate............	46 ,, ...	62·5 95 × 4–5.
3-septate............	1·5 ,, ...	35 65 × 4 4·5.

Bean pod, culture 2 weeks old, conidia from sporodochia.

8-septate............	0·5 per cent......	85–105 × 5.
7-septate............	2 ,, ...	75–85 × 5.
6-septate............	4 ,, ...	62·5–70 × 4·5–5·5.
5-septate............	88 ,, ...	60 70 × 4–5.
4-septate............	1 ,, ...	42·5–50 × 4·5–5.
3-septate............	4·5 ,, ...	32·5 52·5 × 3·75 4·5.
1-septate............	Few...............	10–15 × 4–5.
0-septate............	Few...............	10–12 × 3·75 5.

Fusarium stilboides Wr.

Wollenweber, Fusarium-Monographie, 385, 1931; Fus. aut. del. 966–968. Wollenweber and Reinking, Die Fusarien, 94–95, 1935.

Syn. *Fusarium stilboides* v. *minus* Wr.

F. fructigenum Fr. v. *majus f.* 1 Wr. et Rkg.

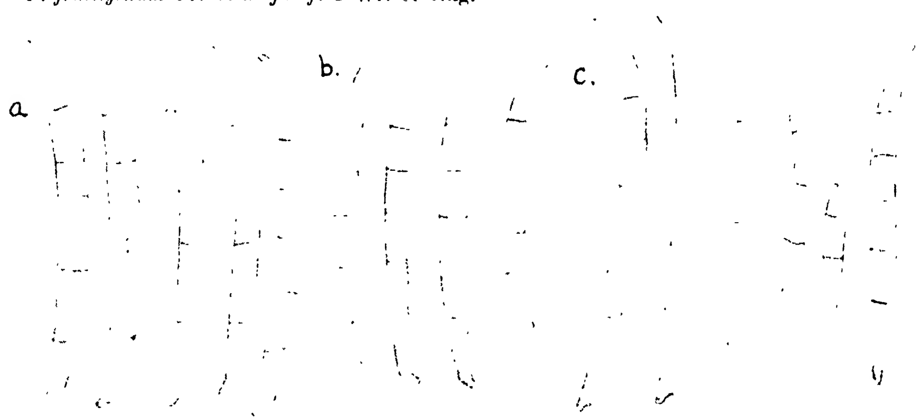

Fig. 21.

Fusarium stilboides Wr.; Conidia from (*a*) pionnotes of 2 weeks old culture on oat agar, (*b*) sporodochia of 4 weeks old culture on Melilotus stem and (*c*) pionnotes of 4 weeks old culture on hard potato agar.

Aerial mycelium floccose, abundant or sparse, at first white, then becoming pink or yellow through diffusion of colour from the stroma. Plectenchymatous stroma honey yellow to carmine red. The mycelium may also be flecked with blue in the neighbourhood of small dark blue, sclerotial masses, which later become covered with a conidial layer. Conidia at first scattered or in false heads, later produced in sporodochia and pionnotes. Conidia are often produced so freely, that sporodochia become columnar and up to several

millimetres long. Smaller 0–1-septate conidia occur, but are scarce and scattered; they are oval, fusiform of pyriform; 2–3-septate conidia are also scarce. Macroconidia in sporodochia and pionnotes are large, cylindrical, more curved at the ends than in the middle, constricted at the apex, definitely pedicellate at the base, mostly 5-septate, less frequently 3–7- exceptionally 8–16-septate.

0-septate............	5– 11 × 2·5–3......	Average 7 × 2·7.
1-septate............	11– 19 × 2·8–5·7....	Average 15 × 3·2.
3-septate............	16–48 × 2·7–5......	Mostly 24–33 × 3·1–4.
5-septate............	40– 97 × 3·3–6......	Mostly 48–73 × 3·5–5·1.
7-septate............	56–105 × 3·5–6......	Mostly 66–90 × 4–5·1.
9-septate............	69–110 × 3·8–6......	Mostly 70–92 × 4·3–5·2.
10–16-septate............	70– 98 × 5–6.	

Dark blue, spherical sclerotia, 0·35–0·6 mm. in diameter, sometimes occur on the stroma. Chlamydospores wanting.

Hab. *Carica papaya* L., from rotting pawpaw fruit (fruit covered with rose coloured mycelium) Bathurst, Cape, Nov. 1931.

Citrus sinensis Osbeck, from more or less extensive, stem end rot of navel and Valencia oranges, after 6–18 weeks in storage; fruit from White River, E. Transvaal.

Coffea arabica L., on coffee berries, Lemana, N. Transvaal, Jan. 1931 (Watson) M.H. 28408. In this collection, *F. stilboides* was associated with *F. lateritium* v. *longum* and a *Capnodium* sp.; the presence of the latter fungus suggests that the berries had been attacked by scale insects.

This species has often been found associated with *Nectria coccophila* on scale insects, on living leaves and branches of *Citrus* spp., and on blister rust, (*Peridermium*) on *Pinus* chiefly in sub-tropical regions, but also in the temperate zone. It is known in America, Asia and Australia.

Growth on Standard Media.

Oat agar: Aerial mycelium fairly short and sparse, white, cobwebby. Growth in substratum eugenia red to acajou red and ochraceous buff to primuline yellow. In old cultures, there sometimes developed a few large, erect, branched sclerotial outgrowths, which were dirty white to greenish blue. Sporodochia began to develope after 7 days. they were numerous, minute (up to 1 mm. diam.), and frequently coalesced to form a pionnotal layer; they were light pinkish cinnamon or were stained with the colour of the stroma.

Hard potato agar: Aerial mycelium sparse, white, chiefly at the top of the slant; Growth in substratum colourless. Pionnotes formed after 7 days; they were light vinaceous cinnamon.

Standard synthetic agar plus starch: Aerial mycelium sparse to none. Growth in substratum eugenia red to acajou red and honey yellow to ochre; after 8 weeks this colour had faded. Sporodochia and pionnotes as on oat agar.

Potato agar plus 5 per cent. dextrose: Aerial mycelium none, or rose colour to honey yellow. Growth on substratum pale to indian lake, or carmine to ox-blood red. Pionnotes, when present, copious, pinkish buff to light pinkish cinnamon.

Potato plug: Growth slow, white, wrinkled, felt-like; or aerial mycelium rather coarse, rose pink to deep rose pink and yellow. Growth in substratum indian lake to pomegranate purple. Sporodochia rather large, forming erect columns to a height of 3–4 millimetres, light pinkish cinnamon.

Melilotus stem: Aerial mycelium scanty, or covering the stems; in the latter case it is sericeo-tomentose, and white to deep rose pink and rose colour. Numerous minute sporodochia developed in groups and formed slender columns 1–2 mm. long; they were light pinkish cinnamon.

Bean pod: Aerial mycelium sparse, white; or more vigorous, tomentose, and tinged rose pink and mustard yellow. Pionnotes and small sporodochia appeared after 7 days and were light vinaceous cinnamon.

Rice : Aerial mycelium white to naples yellow and mustard yellow ; growth on substratum honey yellow and amaranth purple. The red and yellow colour faded after 4 weeks, and the rice was then wood brown, Some pinkish cinnamon sporodochia developed on the grains.

Measurements of Conidia.

Oat agar, culture 4 weeks old, conidia from sporodochia.		
7-septate	2 per cent	60–65 × 4·7–5.
6-septate	11 ,,	52·5–65 × 5.
5-septate	59 ,,	40–77·5 × 3·75–5.
4-septate	25 ,,	35–67·5 × 3·75–5.
3-septate	3 ,,	25–55 × 3·75–4·7.
5-septate conidia sometimes over 90 per cent.,		50–70 × 4–5.
Hard potato agar, culture 4 weeks old, conidia from pionnotes.		
7–8-septate	Rare	73–85 × 5–6.
6-septate	1 per cent	65–75 × 5.
5-septate	57 ,,	46–68 × 4·7–5.
4-septate	17 ,,	40–60 × 4·7–5.
3-septate	24·5 ,,	29–59 × 3·7–4·7.
2-septate	0·5 ,,	
Potato plug, culture 4 weeks old, conidia from sporodochia.		
6-septate	0·5 per cent	52·5–65 × 5.
5-septate	80·5 ,,	52·5–79 × 5.
4-septate	11·5 ,,	52·5–63 × 4·7–5.
3-septate	6·5 ,,	30–55 × 3·75–5.
1-septate	1 ,,	

The size of the conidia in the strains studied was somewhat below the average for the species ; they were at first diagnosed as v. *minus* this variety now being merged in the species.

Section LISEOLA.

Fungi belonging to this section have two conidia forms, micro- and macroconidia. Microconidia minute, 0–1-septate, fusiform to ovoid, seldom pyriform, in some forms produced in long chains or false heads, later scattered freely and forming a light powder over the mycelium. Macroconidia delicate, slender, subulate, almost cylindrical, almost straight or curved, somewhat dorsiventral, fusiform to falcate, tapering at both ends, sometimes bent at rather a sharp angle, abruptly constricted at the apex, more or less pedicellate at the base. The conidia vary in form between those of the *Lateritium* and *Roseum* sections, and also somewhat resemble those of the *Elegans* section. Macroconidia scattered, or in sporodochia and pionnotes ; in mass they are brownish white, or isabellinous to salmon orange, when dry becoming brick red, cinnamon brown or pale. Chlamydospores wanting. Stroma effuse, plectenchymatous, pale, brownish white, pink or violet, smooth, wrinkled or sclerotially erumpent, and sometimes bearing spherical, dark blue sclerotia. Some representatives of this group are the conidial forms of *Gibberella*.

Only two forms have been found in South Africa :—

Microconidia in chains...................... *F. moniliforme.*
Microconidia not in chains.................... *F. moniliforme* v. *subglutinans.*

Fusarium moniliforme Sheldon.

Sheldon, A corn mould (*Fusarium moniliforme* n. sp.), Nebraska Agric. Exp. Sta. Rept. 17 : 23–32. 1904. Wollenweber, Fusarium-Monographie, 391–395, 1931 ; Fus. aut. del. 197, 366, 970–973, 976, 1157–1161. Wollenweber and Reinking, Die Fusarien, 98–100, 1935.

Syn. *Fusarium moniliforme* Sheld. v. *erumpens* Wr. et Rkg.
F. moniliforme Sheld. v. *majus* Wr. et Rkg.
F. moniliforme Sheld. v. *fici* Caldus.
F. celosiae Abe ; *F. samoense* Gehrm. pr. p.

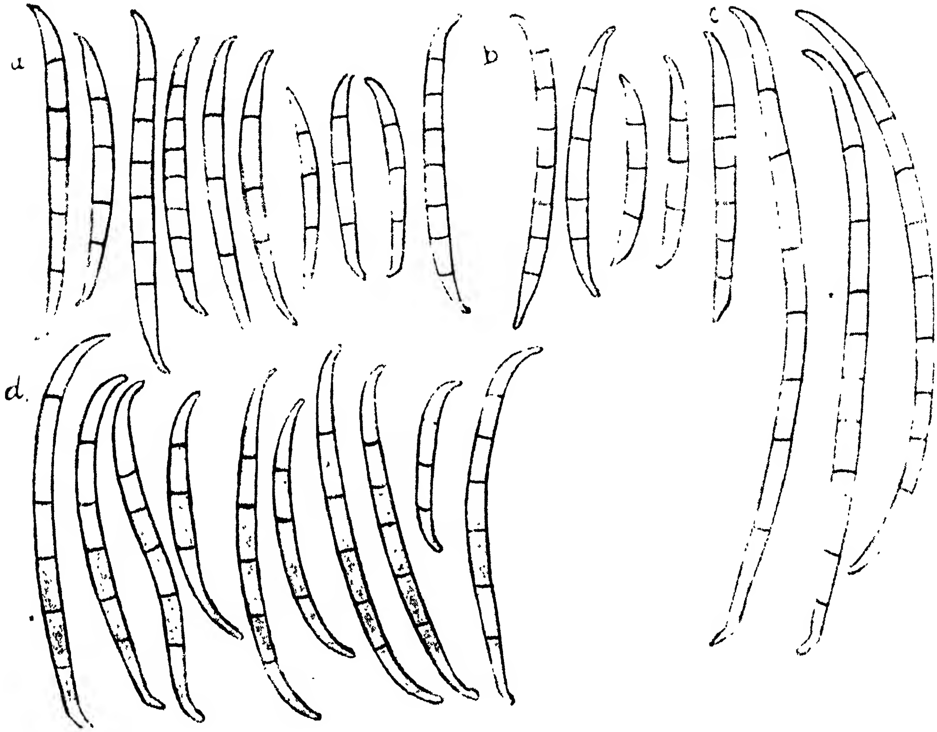

FIG. 22A.

Fusarium moniliforme Sheld. ; conidia from (*a*) sporodochia of 12 weeks old culture on standard synthetic agar plus starch, (*b*) sporodochia of 11 weeks old culture on oat agar, (*c*) longer forms often predominant in pionnotes of 2 weeks old cultures on standard synthetic agar plus starch, (*d*) conidia from sporodochia of 12 weeks old culture on standard synthetic agar plus syarch . (*a-c*) strain from tomato seed, (*d*) from maize.

Microconidia in chains or in false heads, 1–2-celled, fusiform-ovoid, usually very numerous, and later, when scattered, forming an inconspicuous light powder over the aerial mycelium ; the powder is isabellinous or pinkish. Macroconidia delicate, subulate, slightly curved or almost straight, tapering at both ends, often constricted and sometimes rather abruptly bent at the apex, pedicellate or sub-pedicellate at the base. Macroconidia scattered, or produced in sporodochia and pionnotes, in mass pale, isabellinous or salmon orange, becoming brick red to cinnamon red or pale when dry.

0-septate............	4–18 × 1·5–4........	Mostly 5–12 × 2–3. .
1-septate............	9–30 × 2–5..........	Mostly 12–22 × 2·2–3·5.
3-septate............	20–60 × 2–4·5.......	Mostly 32–50 × 2·7–3·5.
5-septate............	37–70 × 2–4·5.......	Mostly 41–63 × 2·7–4.
7-septate............	58–90 × 2·5–4·5.....	Mostly 61–82 × 2·7–4·2.

Chlamydospores wanting. Dark blue sclerotia, 0·08 × 0·1 mm. diam., may be present or absent. Stroma more or less plectenchymatous, yellowish, brownish or violet.

This species is very variable in the size and septation of its conidia. It occurs in tropical and sub-tropical regions of Asia, America, Africa, Australia and Melanesia, on a number of different hosts ; it is chiefly known as a parasite of cereals and other grasses.

The ascus stage of *F. moniliforme* is *Gibberella Fujikuroi* (Saw.) Wr., which was first described on rice in 1917. It has not been found in South Africa, but is known elsewhere on rice, sugar cane and maize, and possibly on other host plants.

Gibberella Fujikuroi (Saw.) Wr.

Syn. *Lisea Fujikuroi* Saw.

Wollenweber and Reinking, Die Fusarien, 99–100, 1935. Wollenweber, Fus. aut. del. 819, 820.

Gibberella moniliformis (Sheld.) Wineland.

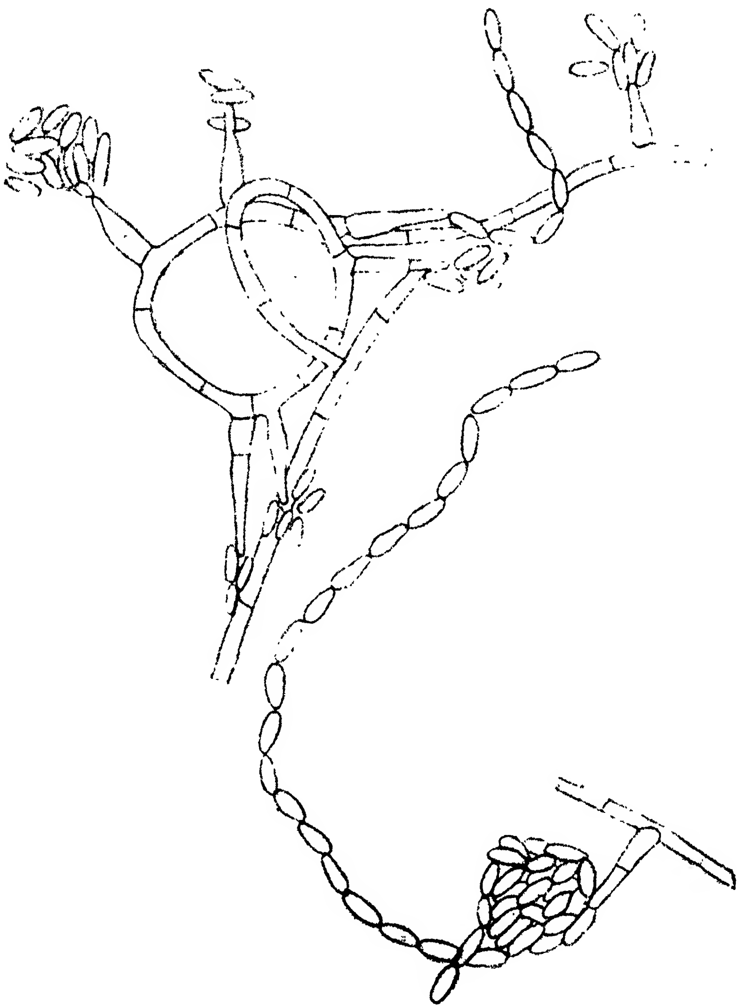

FIG. 22B.

Fusarium moniliforme Sheld.; from plain agar plates, conidiophores bearing microconidia.

Perithecia dark blue, spherical to ovoid, verrucose, 0·19–0·39 × 0·16–0·42 in diameter. Asci paraphysate. Paraphyses septate, clavate, 84–150 × 9–18 μ. Asci cylindrical to clavate, flattened at the apex, 66–129 × 7–14, mostly 4–6-spored, seldom 8-spored. Spores monostichous or imperfectly distichous, 1-septate, 10–24 × 4–9, mostly 14–18 × 4·4–7. Spores occasionally 2–4-septate before germination.

This fungus is the cause of the so-called "*Bakanae*"-disease of rice seedlings, the "*Pokkah-boeng*" disease of sugar cane, and of similar diseases of maize.

The conidial stage has been found on a number of hosts in South Africa.

Hab. *Allium Cepa* L., from rotting bulb of onion, Pretoria, 1929 (ass. *F. vasinfectum* v. *zonatum f.* 2) (Wager).

Ananas comosus Merr., from brown, decaying spots in pineapples from Bathurst Dist., Cape, offered for sale in Pretoria (brown spots round flowers more extensive and lighter in colour than those caused by *Penicillium* sp.).

Brassica oleracea L., from stems of wilting plants, Buffelspoort, Marikana, Rustenburg Dist. (ass. *Rhizoctonia* and *Pythium* sp.) (Turner).

Citrus sinensis Osbeck, from fruit showing stem end rot after 12–18 weeks in storage; navel oranges from Sunday's River, Cape, and Rustenburg, Transvaal, and Valencia oranges from Sunday's River.

Eleusine indica Gaertn., from stems of goose grass (ass. *Helminthosporium* sp.) Acton Homes, Natal, 1931 (L. A. Doidge).

Euphorbia crassipes Marloth, on rotting stems, Willeston, Cape (ass. *F. lateritium*).

Gossypium sp., from stems of wilting seedlings, probably following *Pythium* sp., Rustenburg, Transvaal (Moore).

Lycopersicum esculentum Mill., on seed offered for sale, Pretoria, (several isolations (Wager).

Musa Sapientum L., from fruit affected by 'tip rot,' Acornhoek, (Boyce).

Nicotiana Tabacum L., from stems of wilting seedlings, probably following *Pythium.* sp., Rustenburg (Moore).

Persia americana Mill., from roots of trees shewing die-back (also from soil), Malelane, E. Transvaal (Wager).

Phlox Drummondii Hk., from stems of wilting plant (ass. *Rhizoctonia*), Pretoria.

Pisum sativum L., from wilting stem, Carnarvon, Cape (Wager).

Pyrus malus L., from brown cores of fruit, Vereeniging, 1935–1936 (Bottomley).

Solanum tuberosum L., from tubers affected by dry rot, Umhlanga Beach, nr. Mt. Edgecombe, Natal (van der Plank).

Sorghum vulgare Pers. v. *Caffrorum* Beauv. (= *Andropogon sorghum*), from heads of kaffir corn moulding in the sheath, Pretoria University farm (F. du Toit).

Sorghum vulgare Pers. v. *technicum* (Koern.) Jab., from rotting stem of broom corn, Pretoria University farm (F. du Toit).

Striga lutea Lour., from stems of dying witchweed plant, Pretoria (F. du Toit).

Triticum sp., from stems of wheat plants with blind ears, Losperfontein, Transvaal (Leeman).

Zea Mays L., from mouldy grain, cobs and maize meal; Bethal, O.F.S. (meal said to be unfit for human consumption) M.H. 28382; Settlers, Springbok Flats (grain showed a low percentage of germination) (E. du Toit); Louis Trichardt, N. Transvaal (maize germinating on cobs); Pretoria (young green mealie cob on Pretoria market, grains turning light brown and decaying in patches with some pink discoloration).

From stems of plants which were stunted or were affected by foot rot (numerous isolations), Pretoria, Immerpan and Warmbaths, Transvaal.

Eggs, from purplish brown, discoloured patches on membrane, which at this point adhered to the shell, albumen partly coagulated (ass. *F. semitectum* v. *majus*) sent by Poultry Inspector, Port Elizabeth (Bottomley).

Growth on Standard Media.

Oat agar : Aerial mycelium usually fairly plentiful, matted, arachnoid, white to hydrangea pink and pale brownish vinaceous. Growth on substratum colourless, or deep purplish vinaceous to perilla purple; in older cultures it was sometimes blue-black in places. Pionnotes, when present, pale pinkish cinnamon.

Hard potato agar : Mycelium scant to moderate in amount, white to seashell pink, rather coarse, cottony, or mealy in appearance owing to the presence of numerous conidia. Pionnotes, when present, light ochraceous salmon to vinaceous.

Standard synthetic agar plus starch : Aerial mycelium none or scanty, white or tinged pinkish buff. Growth in substratum vinaceous lavender to deep purplish vinaceous; the medium sometimes had a brownish tinge. Pionnotes formed over the face of the slant; they were pinkish buff to pinkish cinnamon.

Potato agar plus 5 per cent. dextrose : Aerial mycelium sparse to moderate in amount, cottony or tomentose, white to flesh pink or light vinaceous lilac. Growth in substratum vinaceous purple to delft blue and blue-black. Sometimes the agar under the slant was stained acajou red.

Potato plug : Plug covered with a dense, matted mycelium, which was white to pale flesh colour or pale vinaceous lilac. A few minute, deep delft blue sclerotia developed in some tubes, and a few small sporodochia.

Melilotus stem : Growth scant to moderate in amount, white to seashell pink, cottony or mealy owing to the presence of numerous conidia.

Bean pods : Pods covered with a mycelium which was dense, downy or cobwebby, or rather sparse, coarse and tomentose; it was white to ochraceous salmon or pinkish cinnamon. Pionnotes developed in some tubes.

Rice : Growth at first white to alizarine pink and old rose; after 6 weeks, it was alizarine pink to eugenia red and dark vinaceous in places, spinel red next to the grains; at the base of the tube, there was a tinge of dusky auricula purple. The grains were light ochraceous buff to mustard yellow.

Measurements of Conidia.

Standard synthetic agar plus starch, culture 3 months old, conidia from mycelium.

6-septate	1 per cent	55–62·5 × 3–3·75.
5-septate	6 ,,	40–60 × 3–3·75.
4-septate	1 ,,	40–45 × 3–3·75.
3-septate	32 ,,	22·5–57·5 × 3–3·75.
2-septate	1 ,,	20–25 × 2·5–3.
1-septate	7 ,,	12·5–20 × 2–3.
0-septate	52 ,,	5–10 × 2·5–3·75.

Standard synthetic agar plus starch, culture 14 days old, conidia from pionnotes.

11–13-septate	117·5–147·5 × 4·5.
10–12-septate	100–120 × 3·75–4·4.
8–9-septate	85–117·5 × 2·8–4·4.
7-septate	75–112·5 × 3·7–4·5.
6-septate	62·5–85 × 2·8–5.
5-septate	40–82·5 × 2·8–3·75.
4-septate	56 × 2·5.
3-septate	25–52·5 × 3–3·75.

Hard potato agar, culture 14 days old, conidia from pionnotes.

7-septate	Few	65–82·5 × 3·75.
6-septate	0·5 per cent	65–77·5 × 3–3·75.
5-septate	3 ,,	47·5–72·5 × 3–4·5.
4-septate	3·5 ,,	45–64 × 3·75.
3-septate	14 ,,	32·5–70 × 2·8–3·75.
0–1-septate	79 ,,	

The above measurements were from different cultures of the same strain, and serve to illustrate the variability in the size and septation of the conidia of *F. moniliforme.*

Fusarium moniliforme Shel. var. subglutinans Wr. et Rkg.

Wollenweber and Reinking, Phytopathology 15: 163, 1915; Die Fusarien, 100–101, 1935; Wollenweber, Fusarium-Monographie, 397, 1935; Fus. aut. del. 974, 1121, 1122.

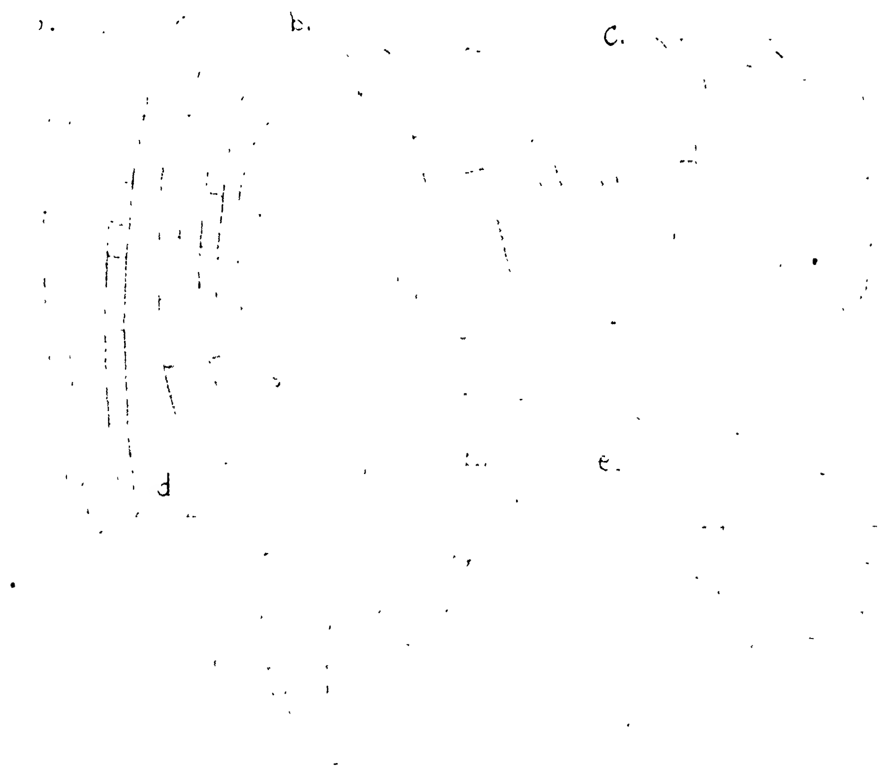

FIG. 23A.

Fusarium moniliforme Sheld. v. *subglutinans* Wr. et. Rkg.; conidia from (*a*) pionnotes of culture on hard potato agar, (*b*) pionnotes of culture on oat agar, (*c*) pionnotes of culture on potato plug, (*d*) pionnotes of culture on oat agar, (*e*) sporodochia of rice culture; cultures all 4 weeks old; (*a-c*) strain 632 and (*d-e*) strain 631, both from maize.

This form differs from the type chiefly in the microconidia, which are not produced in chains. The macroconidia are 3–5-septate, seldom 7-septate.

0-septate............	6–15 × 1·7–4........	Mostly 7–12 × 2–3·5.
1-septate............	10–28 × 2·2–4·5.....	Mostly 14–20 × 2·5–3·5.
3-septate............	18–60 × 2·5–4·5.....	Mostly 25–48 × 3–4.
5-septate............	40–61 × 3–4·5.......	Mostly 43–53 × 3·2–4.
6–7-septate............	48–57 × 3·25–4·5.	

Chlamydospores wanting. Dark blue, spherical sclerotia and irregular, erumpent sclerotial stromata may be present or absent.

This variety occurs on wheat, maize, sugar-cane and other Gramineae, and on a number of other hosts in tropical and sub-tropical regions of America, Asia, Africa and Australia; it occurs less frequently in Europe. The ascus stage has been found in Australia by Edwards (15) and may be described as follows:—

Gibberella Fujikuroi (Saw.) Wr. var. **subglutinans** Edwards.

Edwards, Dept. of Agric. New South Wales, Sci. Bull. 49, 1935. Wollenweber and Reinking, Die Fusarien, 101, 1935. Wollenweber, Fus. aut. del. 1121, 1122.

The perithecia are dark blue, somewhat rough, spherical to ovoid, and are similar in size to those of the type. Asci paraphysate, 4–8-spored, clavate. Paraphyses ascending from the base of the perithecium, about 6-celled, 70–100 × 6–15. Spores 1-septate, 11–22 × 3–8; exceptionally 2–3-septate, 18–23 × 4–6.

On maize, causing a disease of seedlings and older plants. Only the conidial stage has been found in South Africa.

Hab. *Brassica oleracea* L., from stems of dying cabbage plants (ass. *Rhizoctonia* and *Pythium* sp.), Buffelspoort, Marikana, E. Transvaal (Turner).

Citrus sinensis Osbeck, from stem end rot of Valencia oranges after 18 weeks in storage, fruit from Rustenburg, 1933–34.

Kniphofia sp., on capsules, Loskop, Natal (Galpin) M.H. 28385.

Pyrus malus L., from brown cores of fruit, Vereeniging, 1935–36 (Bottomley).

Saccharum officinarum L., from dying leaf of sugar cane, Durban, Oct. 1931 (McLean).

Zea Mays L., from mouldy grain, cob and maize meal, Bethal, O.F.S., M.H. 28379 and 28380; Zoological Gardens, Pretoria; Klip River, Natal (Watts) M.H. 28413; Kenya (McDonald) M.H. 28422; from maize germinating on cob, Driehoek, Piet Retief (Leemann). From stems (upper nodes) and collapsed leaf bases, Kinross, Transvaal, M.H. 28406.

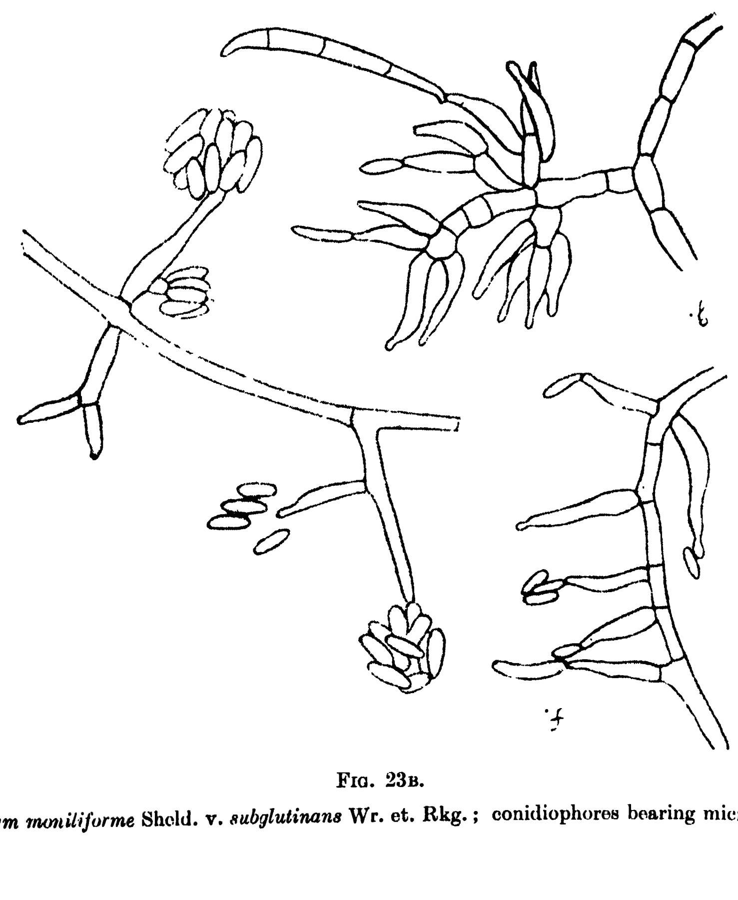

FIG. 23B.

Fusarium moniliforme Sheld. v. *subglutinans* Wr. et. Rkg.; conidiophores bearing micro- and macroconidia.

Growth on Standard Media.

Oat agar : Aerial mycelium very sparse, or more frequently wanting. Growth in substratum pale to deep purplish vinaceous, anthracene purple and perilla purple. When the stroma was purple, the agar became stained the same colour. Pionnotes rather thin, flesh colour to salmon buff.

Hard potato agar : Aerial mycelium short, sparse, tomentose ; growth in substratum colourless, or with patches of blue-black near the base of the slant. A few salmon buff sporodochia developed.

Standard synthetic agar plus starch : Aerial mycelium sparse to none ; growth on substratum pale or acajou red to deep purplish vinaceous ; when purplish, the colour of the stroma became diffused into the agar. Pionnotes light vinaceous cinnamon, or becoming reddish through absorption of the colour of the stroma.

Potato agar plus 5 per cent. dextrose : Aerial mycelium short, sparse, rather coarse, tomentose, white to pale vinaceous lilac. Growth on substratum perilla purple to vandyke red and Hay's maroon. Pionnotes at first salmon buff ; both pionnotes and agar became stained with the colour of the stroma.

Potato plug : Plug covered with copious mycelium, which was cottony, white to flesh pink. Growth in substratum was deep delft blue in patches, and a few minute, blue-black sclerotia were sometimes present. Pionnotes developed freely, they were light ochraceous salmon to salmon.

Melilotus stem : Stems covered with a short, tomentose mycelium, which was white to congo pink. Conidia were produced in a dense, vinaceous cinnamon pionnotes, or light ochraceous salmon sporodochia developed ; these coalesced when numerous, and formed a continuous pionnotal layer.

Bean pod : Aerial mycelium short, sparse, white ; patches of blue-black sometimes developed on the substratum. Pionnotes very copious, salmon colour to cinnamon.

Rice : Growth Chatenay pink and pale vinaceous lilac to perilla purple. Pionnotes or sporodochia often developed on the surface of the grains ; they were salmon colour to cinnamon.

Measurements of Conidia.

Hard potato agar, culture 2 weeks old, conidia from pionnotes.

5-septate	8 per cent	52·5–85 × 2·8–3·75.
4-septate	8 ,,	47·5–70 × 2·8–3·5.
3-septate	38 ,,	22·5–55 × 2·8–3·5.
2-septate	3 ,,	18 28 × 2·4-4·5.
1-septate	23 ,,	9–18 × 2·4–3·6.
0-septate	20 ,,	4-11 × 2·5–4.

Bean pod, culture 2 weeks old, conidia from pionnotes.

6-septate	Few	55–57·5 × 3–3·75.
5-septate	2 per cent	42·5–57·5 × 2·8–3.
4-septate	5 ,,	42·5–52·5 × 2·8–3.
3-septate	64 ,,	20–50 × 2·5–3.
2-septate	3 ,,	22–27 × 3–3·5.
1-septate	18 ,,	10–19 × 3–3·5.
0-septate	8 ,,	5–12 × 2·5–3·5.

Potato plug, culture 5 weeks old, conidia from sporodochia.

6-septate	1 per cent	43·5–45 × 3·65–4·5.
5-septate	25 ,,	35-47·5 × 3·75–4·5.
4-septate	18 ,,	35–47·5 × 3–4·5
3-septate	35 ,,	22·5–40 × 2·8–5.
2-septate	1·5 ,,	20 × 2·8.
1-septate	8 ,,	18–24 × 2·8.
0-septate	11·5 ,,	4·5–2 × 2·5–3·5.

Oat agar, culture 5 weeks old, conidia from pionnotes.

6-septate............	Rare.................	$42 \cdot 5 \times 4 \cdot 4$.
5-septate............	3 per cent..........	$37 \cdot 5$–50×4–$4 \cdot 5$.
4-septate............	4 ,, ...	$37 \cdot 5$–$52 \times 3 \cdot 5$–$4 \cdot 5$.
3-septate............	44 ,, ...	19–$42 \cdot 5 \times 2 \cdot 8$–$4 \cdot 5$.
2-septate............	1 ,, ...	18–25×3–$3 \cdot 75$.
1-septate............	9 ,, ...	11–$20 \times 2 \cdot 8$–3.
0-septate............	39 ,, ...	6–$12 \times 2 \cdot 5$–3.

Section ELEGANS.

Wollenweber, Phytopathology 3: 28, 1913; Fusarium-Monographie, 400–406, 1931. Wollenweber and Reinking, Die Fusarien, 104–109, 1935.

Fungi with two conidial forms, microconidia and macroconidia. Microconidia ovoid-ellipsoid, straight or reniform, 5–12 × 2·2–3·5, single on free conidiophores, or loosely agglutinated in false heads. Macroconidia in tubercularia-like sporodochia or in an extended pionnotal layer, on closely crowded, freely branched conidiophores. The conidial masses are formed on an erumpent or flat, plectenchymatous or sclerotial stroma; they form a convex layer, or appear in small masses, like grains of sand, which readily become coalescent; when dry, these form a hard, resinous crust, or a powdery layer. In some species, the macroconidia are elongated, fusiform to subulate, tapering at both ends or slightly constricted; in others they are more compact, fusiform-falcate, usually constricted and abruptly curved at the apex, and pedicellate or papillate at the base. Macroconidia are dorsiventral to almost cylindrical, thin-walled, usually with 3, or up to 5, delicate cross walls; their measurements vary, but they are of medium size, 3-septate 27–46 × 3–5, 5-septate 50–60 × 3–5; in mass they are pale, isabellinous, brownish-white, flesh colour to salmon orange. Mycelium white, or stained with the colour of the stroma. Stroma pale or pink, orange colour or purple red, plectenchymatous, effuse or raised, more or less erumpent and sclerotial, with smooth or wrinkled surface, and sometimes with elongated or stalk-like outgrowths which are light, or dark green to blue-black. Chlamydospores plentiful, terminal and intercalary, in mycelium and conidia. Sclerotia, which may be rough, and brown, blue or pale, present or wanting.

This group includes a number of organisms causing vascular wilt diseases, which are more or less specific, on certain hosts, and also organisms causing rots of bulbs, tubers, roots and fruit.

A number of species and varieties have been recorded on various hosts in South Africa; it is possible that other cosmopolitan wilt-organisms are present, and have not yet been identified. In addition to the forms recorded on the following pages, undetermined strains of Fusaria belonging to the *Elegans* section have been isolated from the following hosts: *Crotalaria juncea*, *Dahlia* sp., *Datura stramonium*, *Dimorphotheca aurantiaca*, *Fragaria* sp., *Gilia rubra*, *Persea americana*, *Physalis angulata*, *Prunus persica* and *Rheum rhaponticum*. A full key is given to the species of this section, which comprises so large a number of specific plant parasites.

Key to the Species.

A.—Fungi typically without sporodochia............... **Sub-section Orthocera.**

a.—Pionnotes typically wanting. Conidia 1-celled, or sparingly septate.

b.—Conidiophores with bostrycoid branching..... *F. bostrycoides*.

bb.—Conidiophores simple, or with branches in whorls.

c.—Stroma pale, brownish white to flesh colour.

d.—Plectenchyma sometimes erumpent. Macroconidia not numerous.

e.—Conidia when 3-sept., 34 × 3·5; 5-sept., 43 × 3·6; 7-sept., 59 × 3·7 .... *F. conglutinans* v. *callistephi*

dd.—Plectenchyma not erumpent. Macroconidia not numerous, 3-sept. 30 × 3·4.

e.—Pathogenic to *Brassica oleracea* *F. conglutinans.*

ee.—Pathogenic to *Beta vulgaris* ..... *F. conglutinans* v. *betae.*

eee.—Pathogenic to *Apium graveolens* *F. orthoceras* v. *apii f.* 1.

eeee.—Pathogenic to *Pisum sativum* ... *F. orthoceras* v. *pisi.*

cc.—Stroma red, violet, red-brown or rust-red.

d.—Stroma chestnut brown, rust-red, pink; pea-wilt organism .... *F. orthoceras* v. *pisi.*

dd.—Stroma purple violet; conidia when 3-sept. 33 × 3·5; 5-sept. 43 × 3·9 *F. orthoceras.*

ddd.—Stroma red-violet; pathogenic to celery (*Apium graveolens*) .... *F. orthoceras* v. *apii.*

aa.—Pionnotes sparse or wanting.

b.—Stroma pale, brownish white, then yellow, not red.

c.—Conidia, when 3-sept., 28 × 3·5 .... *F. conglutinans* v. *citrinum.*

bb.—Stroma pink to purple.

c.—Conidia, when 3-sept., 39 × 4; 5-sept., 49 × 4·4 .... *F. orthoceras* v. *longius.*

cc.—Conidia comparatively long, tapering gradually to the apex; 3-sept. 36 × 3·5; 5-sept. 60 × 4·2 .... *F. angustum.*

aaa.—Fungi sometimes with sporodochia.

b.—Macroconidia 3-sept. 30 × 3·2; or in sporodochia 3-sept. 35 × 4; pathogenic to flax (*Linum*) causing wilt .... *F. lini.*

aaaa.—Fungi typically with sporodochia.

b.—Macroconidia comparatively slender, 3-3·7 μ thick .... **Sub-section Constrictum.**

c.—Conidia more or less 3-sept.

d.—Conidia very slender; 3-sept. 33 × 3·2 .... *F. bulbigenum* v. *tracheiphilum.*

dd.—Conidia somewhat thicker; 3-sept. 35 × 3·5 .... *F. bulbigenum* v. *blasticola.*

cc.—Conidia more or less 3–5-sept.

d.—Stroma more or less sclerotial, pale not blue.

e.—Conidia 3-sept. 37 × 3·4; 5-sept. 49 × 3·5 .... *F. bulbigenum* v. *lycopersici.*

dd.—Stroma, when sclerotially erumpent, blue to pale.

e.—Sclerotial bodies small, numerous, 0·1–3 mm.

f.—Conidia 3-sept. 36 × 3·3; 5-sept. 48 × 3·3 .... *F. bulbigenum* v. *batatas.*

ee.—Sclerotial bodies comparatively large, scattered, 3–6 mm. diam.

f.—Conidia 3-sept. 38 × 3·4; 5-sept. 50 × 3·5........... *F. bulbigenum.*

ff.—Conidia 3-sept. 34 × 3·6; 5-sept. 47 × 3·6........... *F. bulbigenum* v. *niveum.*

bb.—Macroconidia comparatively stouter, 3·7–5 μ thick.. **Sub-section Oxysporum.**

c.—Sclerotia wanting; sclerotial plectenchyma not erumpent.

d.—Conidia not broader in the upper third than in the middle, nor abruptly bent at the apex. Stroma red-violet. Not aromatic. Conidia 3-sept. 38 × 4·3; 5-sept. 47 × 4·3............. *F. oxysporum* v. *aurantiacum f.* 1

dd.—Conidia often broader in the upper third than in the middle, usually abruptly bent near the apex; stroma lilac.

e.—Conidia in mass pale, cream to flesh colour, 3-sept. 36 × 4·7; 5-sept. 44 × 4·7.

f.—Aromatic odour developing in rice cultures............. *F. redolens.*

ff.—No aromatic odour......... *F. redolens f.* 1.

cc.—Sclerotia wanting, but plectenchyma more or less sclerotially erumpent.

d.—Stroma effuse, purple.

e.—Conidia 3-sept. 37 × 3·9; 5-sept. 42 × 4·1. Strongly aromatic.. *F. vasinfectum* v. *zonatum.*

ee.—Conidia 3-sept. 38·5 × 3·7; 5-sept. 42·1 × 4·1. Not aromatic.......................... *F. vasinfectum* v. *zonatum f.* 2.

dd.—Stroma effuse, salmon-orange, not or faintly aromatic.

e.—Conidia 3-sept. 37·1 × 3·8; 5-sept. 43 × 4................ *F. vasinfectum* v. *zonatum f.* 1.

ccc.—Sclerotia present. Sclerotial plectenchyma and sclerotia dark blue to green, sometimes paler.

d.—Sclerotial bodies comparatively small, 0·1–2 mm. or smaller.

e.—Conidia 3-sept. 33 × 3·7; 5-sept. 40 × 3·8.

f.—Pathogens causing cotton wilt.

g.—Fungus aromatic....... *F. vasinfectum.*

gg.—Fungus not aromatic... *F. vasinfectum f.* 1.

ff.—Not causing cotton wilt.... *F. vasinfectum f.* 2.

ee.—Conidia 3-sept. 34 × 3·8; 5-sept. 42 × 4; aromatic............ *F. vasinfectum* v. *lutulatum.*

dd.—Sclerotial bodies comparatively large, 0·5–3·6–12 mm.

e.—Stroma effuse, usually white to flesh colour.

f.—Conidia 3-sept. 35 × 4; 5-sept. 42 × 4·2. Not aromatic, pathogenic to aster (*Callistephus*)............. *F. oxysporum f.* 6.

ee.—Stroma effuse, pink, violet to red.

f.—Conidia 3-sept. 34 × 4; 5-sept. 42 × 4·2. Faintly aromatic. Pathogenic to onion (*Allium*), but not to potato.................... *F. oxysporum f.* 7.

ff.—Conidia 3-sept. 35·1 × 4; 5-sept. 42·4 × 4·2. Aromatic or not aromatic. Pathogenic to peas (*Pisum*)...... *F. oxysporum f.* 8.

fff.—Conidia 3-sept. 35 × 4; 5-sept. 41 × 4·2. Usually aromatic.

g.—Cause of potato (*Solanum*) wilt............. *F. oxysporum f.* 1.

gg.—Cause of rotting in roots, tubers, fruit, etc.; not a specific potato organism. Aromatic or not aromatic.............. *F. oxysporum.*

ggg.—Fungus with copious pionnotes. Cause of wilt of sweet potato (*Ipomoea*). Aromatic.. *F. oxysporum f.* 2.

eee.—Stroma effuse, red-violet. Conidia 3-sept. 35 × 4; 5-sept. 45 × 4·2.

f.—Sclerotia comparatively numerous. Not aromatic. Cause of wilt of tobacco (*Nicotiana*) *F. oxysporum* v. *nicotianae.*

ff.—Sclerotia comparatively few, seldom in groups. Cause of wilt of banana (*Musa*). Aromatic...................... *F. oxysporum* v. *cubense.*

eeee.—Stroma effuse, dark purple to red-violet.

f.—Conidia 3-sept. 35 × 4·3; 5-sept. 45 × 4·3. Not aromatic...................... *F. oxysporum* v. *aurantiacum.*

ff.—Conidia 3-sept. 33 × 4·3; 5-sept. 44 × 4·5; 7-sept. 42 × 4·8. Not aromatic. Cause of *Gladiolus* wilt.... *F. oxysporum* v. *gladioli.*

fff.—Conidia 3-sept. 40 × 4·4; 5-sept. 47 × 4·9. Not aromatic. Cause of wilt of lucerne (*Medicago*)......... *F. oxysporum* v. *medicaginis.*

ffff.—Conidia 3-sept. 34 × 4; 5-sept. 44 × 4·3. Not aromatic. Cause of wilt of carnation (*Dianthus*).......... *F. dianthi.*

Sub-section ORTHOCERA.

Without sporodochia ; pionnotal layers of limited extent sometimes occur. Macroconidia almost straight, fusiform, slightly constricted at both ends, papillate or sub-pedicellate at the base, 3–5-septate, slender, delicate. Three-septate conidia usually 8–10, (up to 12) times as long as broad, and 5-septate 11–13, (up to 17) times as long as broad ; 3-septate conidia 27–46 × 3–4 ; 5-septate conidia, which may or may not be present, 33–50 (up to 60) × 3·5–4. Chlamydospores spherical to pyriform, smooth or verrucose ; sclerotia and sclerotial stromata pale, or green to blue-black.

Fusarium Orthoceras. App. et Wr.

Appel and Wollenweber, Arb. biol. Reichanst. Land. u. Forstw. 8 : 141–156, 1910. Wollenweber, Fusarium-Monographie, 408, 1931 ; Fus. aut. del. 359–362, 620, 621, 985–989. Wollenweber and Reinking, Die Fusarien, 111–112, 1935.

Syn. *Fusarium albido-violaceum* Dasz.

F. orthoceras App. et Wr. v. *albido-violaceum* (Dasz.) Wr.

F. orthoceras App. et Wr. v. *triseptatum* Wr.

F. oxysporum Schl. v. *cucurbitacearum* Rabh.

F. oxysporum Schl. v. *resupinatum* Sherb.

F. oxysporum Schl. v. *asclerotium* Sherb.

F. asclerotium (Sherb.) Wr.

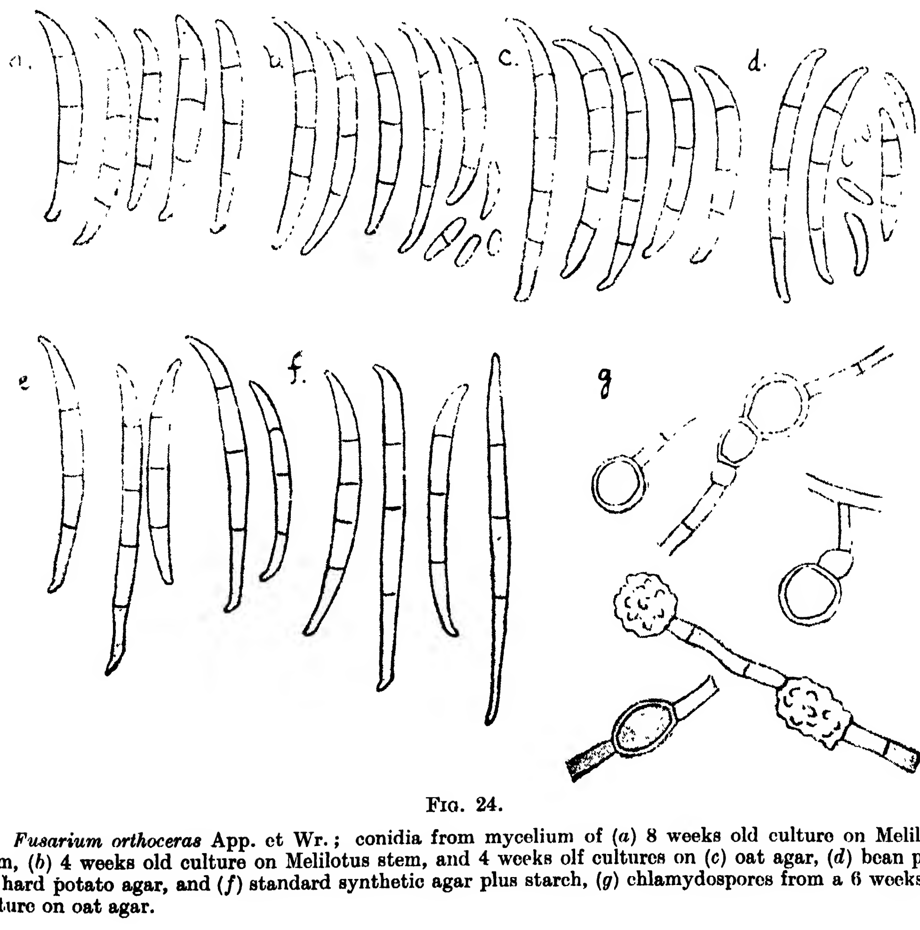

Fig. 24.

Fusarium orthoceras App. et Wr. ; conidia from mycelium of (*a*) 8 weeks old culture on Melilotus stem, (*b*) 4 weeks old culture on Melilotus stem, and 4 weeks olf cultures on (*c*) oat agar, (*d*) bean pods, (*e*) hard potato agar, and (*f*) standard synthetic agar plus starch, (*g*) chlamydospores from a 6 weeks old culture on oat agar.

Stroma caespitose, plectenchymatous, seldom sclerotially erumpent, flesh colour, flecked with green, or purple red to violet. Aerial mycelium usually abundant, floccose, white to pink, readily collapsing and then becoming tough, gelatinous. Conidia, forming freely on the mycelium, are 1-celled or sparsely septate; very few macroconidia are produced. Conidia abstricted successively from the tips of free conidiophores; they soon fall off, or become agglutinated into false heads; occasionally the conidiophores branch more freely, and form a thin, fugaceous, flesh-coloured pionnotes, or a few sporodochia. Microconidia ovoid-cylindrical, straight or curved. Macroconidia almost straight, fusiform-falcate, slender, delicate, indistinctly septate; papillate at the base, or with a tendency towards the pedicellate form.

0-septate............	4–17 × 2·4..........	Mostly 6–12 × 2·5–3·2.
1-septate............	10–41 × 2·5–4·5.....	Mostly 13–27 × 2·5–3·8.
3-septate............	15–61 × 2·4–4·8.....	Mostly 23–36 × 3–4·3.
5-septate............	25–69 × 3·4·8.......	Mostly 33–48 × 3·2–4·5.

Chlamydospores terminal and intercalary, spherical to pyriform, smooth or verrucose; 1-celled 6–14 × 5–13; less frequently 2-celled, 10–21 × 6–13.

Hab. *Solanum tuberosum* L., from tubers showing various forms of storage rot; from tubers imported from England and Germany; tubers from Mokeetsi, Pretoria (Wager) and Leslie, Transvaal; Cedara, (Gill) and Mt. Edgecombe (van der Plank) Natal. Also reported by du Plessis (13), in rotting tubers from Stellenbosch, Paarl and George in the winter rainfall area.

From base of stem of diseased potato plant, Molteno, Cape, March 1930 (Wager).

This fungus appears to be the most common cause of "dry rot" of potato tubers in South Africa. It is a cosmopolitan organism, and occurs more or less commonly in all parts of the world, on decaying subterranean parts of plants and in humus; it occurs less frequently on dead animals, e.g. chameleon.

Growth on Standard Media.

Oat agar : Aerial mycelium short, dense, matted, or sparse, white; Growth on substratum pale to vinaceous lilac, or vinaceous purple to slate violet. In cultures of one strain, a thin, light pinkish cinnamon pionnotes developed on the lower half of the slant.

Hard potato agar : Aerial mycelium moderate to sparse, short, white, cottony to tomentose. Growth on substratum colourless. A thin pionnotes occasionally developed.

Standard synthetic agar plus starch : Aerial mycelium sparse, white, mostly at the top and the bottom of the slant. Growth on substratum tinged light vinaceous purple to slate purple. In culture of one strain, a light pinkish cinnamon pionnotes developed, and also one or two minute sporodochia.

Potato agar plus 5 per cent. dextrose : Aerial mycelium sparse to none, or moderate, and then short, tomentose, white to tourmaline pink and hyssop violet. Growth on substratum flat, or raised and cushion-like, cream, pale purple drab, or light vinaceous purple to dark slate violet.

Potato plug : Plug covered with a dense growth of cottony mycelium, which was at first white to shell pink, or flesh pink and buff pink where it touched the glass. Later there were flecks of dark delft blue in the mycelium at the base of the plug, or patches of dusky green blue to slate violet against the glass. In some cases, after 4 weeks, the mycelium was collapsed, tough and wet-looking.

Melilotus stems : Stems clothed with a fairly copious mycelium, which was tomentose to sericeo-tomentose, or felt-like, white, tinged olive buff to ochre in the dryer parts. Occasionally a few minute, light pinkish cinnamon sporodochia developed (in one strain only).

Bean pod : Pod covered with a moderate growth of mycelium, which was white to olive buff, tomentose, or very coarsely sericeo-tomentose. After 4 weeks, the mycelium was collapsed and wet-looking.

Rice : Growth white to alizarine pink and old rose or bishop's purple, fa ling to dul purple. After 4 weeks the mycelium became collapsed and wet-looking. Cultures had a slight or fairly pronounced odour, resembling that of over-ripe apples. The odour is described by Reinking and Wollenweber (39) as " benzolic."

Measurements of Conidia.

Oat agar, culture 4 weeks old, conidia from mycelium. Conidia nearly a 0-septate a few 1–2-septate, 3–5-septate conidia rare.

0-septate	5–14 × 2·7–3·5.
1-septate	14–18 × 3–4.
2-septate	15–22 × 3·5–4.
3-septate	30–52·5 × 3–4·5.
4-septate	42·5–55 × 3·7–4·5.
5-septate	43–45 × 3·7–4·5.

Bean pod, culture 4 weeks old, conidia from pionnotes.

0-septate	60 per cent	5–15 × 2–3.
1-septate	3 ,,	10–22·5 × 2·5–3·5.
3-septate	26 ,,	25–47·5 × 3–3·75.
4-septate	1 ,,	45–50 × 3·7.

Oat agar, culture 4 weeks old, conidia from pionnotes.

5-septate	4 per cent	40–45 × 3·7.
4-septate	13·5 ,,	37·5–50 × 3·5–4.
3-septate	75·5 ,,	30–47·5 × 2·5–4.
1-septate	1·5 ,,	
0-septate	5·5 ,,	

In pionnotes there were occasionally 80–90 per cent. of 3-septate conidia ; conidia from mycelium were usually about 99 per cent. microconidia.

Chlamydospores terminal and intercalary, common in the mycelium, and occasionally seen in the macroconidia. Form and dimensions agreed with the particulars given in the general description.

Fusarium angustum Sherb.

Sherbakoff, New York (Cornell) Agric. Exp. Sta. Memoir 6 : 203, 1915. Wollenweber, Fusarium-Monographie, 410–411, 1931 ; Fus. aut. del. 365, 991–993. Wollenweber and Reinking, Die Fusarien. 113, 1935.

Syn. *Fusarium sclerostromaton* Sideris.

Stroma plectenchymatous, effuse, pink to purple. Aerial mycelium more or less abundant, white or tinged with the colour of the colour of the stroma, sometimes flecked with delft blue or with green-blue patches. Conidia borne on the mycelium or in a thin pionnotes, pinkish cinnamon in mass, or stained with the colour of the stroma. Conidia elongated, almost cylindrical, straight or slightly curved, tapering at both ends, sometimes curved in more than one direction.

0-septate	5–18 × 2–3·5	Average 11 × 2·6.
1-septate	12–24 × 2·5–4	Average 21 × 3.
3-septate	29–69 × 2·5–4·7	Average 45·6 × 3·5.
5-septate	43–81 × 3·5–4·7	Average 60 × 4·2.
6–8-septate	70–102 × 4–4·7	Average 78 × 4.

Chlamydospores 1-celled, 6–13 μ diam., or 2-celled, 13–18 × 6–10.

Hab. *Arachis hypogaea* L., from pods and seeds decaying while still in the soil, University Farm, Pretoria, 1932 (F. du Toit).

Citrus limonia Osbeck, from lemons decaying after 6 weeks in storage ; fruit from Sunday's River, Cape.

From roots of rough lemon stock on which orange or grape fruit had been budded roots, showing " dry root rot " Zebediela, N. Transvaal, M.H.

28432 and 28441 ; Elizabethville, Belgian Congo ; Steenbokfontein, Rustenburg dist., Transvaal, M.H. 28427 ; Marikana, Rustenburg dist., M.H. 28426 ; Acornhoek, E. Transvaal ; Bonnievale, Cape.

From soil in citrus orchards, Kosterfontein, Marico dist., M.H. 28427 ; Boskoppies, nr. Rustenburg.

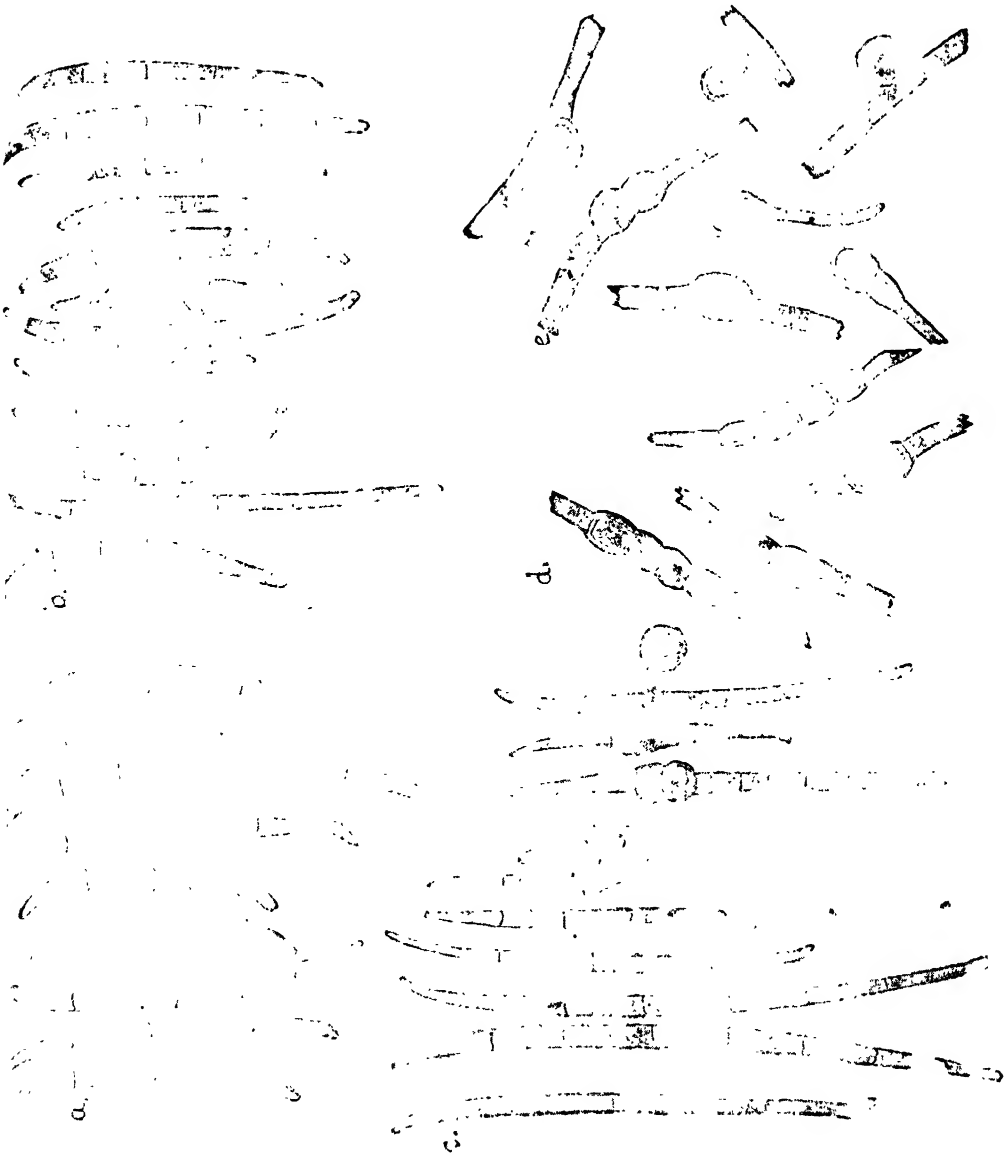

FIG. 25.

Fusarium angustum Sherb. ; conidia from thin pionnotes of 4 weeks old cultures on (*a*) hard potato agar, (*b*) oat agar, and (*c*) standard synthetic agar plus starch. (*d*) chlamydospores from culture on hard potato agar.

Citrus sinensis Osbeck, from fruit showing stem end rot, after 6–18 weeks in storage; from Valencia oranges from White River, Zebediela and Rustenburg, Transvaal; from navel oranges from Zebediela, White River and Letaba, Transvaal, from Groot Drakenstein, Cape, and from Muden, Natal. (23 isolations from oranges in all).

From roots of old seedling orange tree, Villiersdorp, Cape.

Gossypium sp., from stem of wilting plant, (associated with *Phoma* sp.), Rustenburg (Moore).

Lycopersicum esculentum Mill., from rotting petioles, Gqaga, Transkei (ass. *F. sambucinum*); from stems of plants wilting from attack of *Bacterium solanacearum*, Tonetti, E. Transvaal (Wager).

Medicago sativa L., from discoloured tissue of crown of dying plant, Pietersburg, Transvaal.

Pinus sp., from wood with intense yellow discolouration, Hogg's Back, Cape (Lurie).

Polygala virgata Thun., from stem wilting plant. Durban (McClean).

Growth on Standard Media.

Oat agar: Aerial mycelium sparse, consisting of a fringe of white hyphae at the top of the slant. Growth on substratum pale to dull Indian purple. Pionnotes formed on the lower half of the slant; they were light pinkish cinnamon, or were tinged vinaceous purple, through absorption of the colour of the stroma. In some of the strains from *Citrus*, pionnotes were produced more freely over the surface of the slant on this medium and on other media.

Hard potato agar: Aerial mycelium sparse, cottony, white or faintly tinged vinaceous lavender. Growth on substratum colourless. Pionnotes formed on the lower half of the slant; they were light pinkish cinnamon.

Standard synthetic agar plus starch: Aerial mycelium present in patches, tomentose to felt-like, white to vinaceous lilac. Growth on substratum dull Indian purple to vinaceous lilac. Pionnotes light pinkish cinnamon, or tinged vinaceous lilac.

Potato agar plus 5 per cent. dextrose: Aerial mycelium in patches, tomentose to matted, white to vinaceous lilac. Growth on substratum dull Indian purple.

Potato plug: Plug covered with a fairly plentiful fine mycelium, which was cottony to felt-like, and white, tinged seashell pink or deep vinaceous lilac. In some tubes the mycelium was flecked with deep delft blue, or there were patches of dark glaucous grey to green blue slate, especially between the medium and the glass.

Melilotus stem: Stems covered with a moderate growth of mycelium, which was white, or tinged chamois to yellow ochre in places, and cottony to sericeo-tomentose. Pinkish cinnamon pionnotes sometimes formed on the moister parts of the medium.

Bean pods: Aerial mycelium moderate in amount, tomentose to matted, white, or with patches of chamois or yellow ochre. Mycelium became collapsed and wet-looking after 4 weeks.

Rice: Growth white to alizarine pink and acajou red, or sometimes carmine. After 8 weeks, the colour had faded to nigrosin violet.

Measurements of Conidia.

Hard potato agar, culture 12 days old, conidia from pionnotes.

8-septate	Rare	72–90 × 4–4·7.
7-septate	1 per cent	67·5–85 × 4–4·7.
5-septate	2 ,,	50–82·5 × 4–4·5.
4-septate	2 ,,	50–74 × 3–4·5.
3-septate	83 ,,	47·5–72·5 × 3–4·5.
2-septate	1 ,,	35–40 × 3–3·75.
1-septate	3 ,,	20–32 × 2·5–3·75.
0-septate	8 ,,	10·5–17·5 × 2–3·75.

Standard synthetic agar plus starch, culture 4 weeks old, conidia from pionnotes.

6–7-septate............	Rare................	67·5–77·5 × 3·7–4·7.
5-septate............	1·5 per cent........	52·5–80 × 3·7–4·4.
4-septate............	0·5 „	50–77·5 × 3–4·4.
3-septate............	17 „	32·5–62·5 × 3–3·75.
2-septate............	4 „	27·5–45 × 2·5–3·1.
1-septate............	20 „	12·5–20 × 2·8 3.
0-septate............	57 „	5–15 × 2–3.

Chlamydospores formed in mycelium and conidia. Mycelial chlamydospores mostly erminal, at the ends of long slender hyphae, single or in pairs, rugulose; single chlamyospores from 4 weeks old culture on hard potato agar, 7·5–10 μ diam.

Fusarium conglutinans Wr. var. **callistephi** Beach.

Beach, The Fusarium wilt of china aster. Mich. Acad. Sci. Rept. 20: 281–308, 1918. Wollenweber, Fusarium-Monographie, 407–408, 1931; Fus. aut. del. 619. 980. 981. Wollenweber and Reinking, Die Fusarien, 110–111, 1935.

Syn. *Fusarium conglutinans* v. *majus* Wr.

Stroma pale, white, then yellowish, brownish, or pinkish-white, exceptionally with traces of grey lilac. Microconidia scattered, or occasionally covering the substratum with a thin pionnotes, mostly 1-celled, seldom 1-septate, interspersed more or less freely with larger 3–5–7-septate conidia. Macroconidia cylindrical-fusiform, or somewhat curved.

0-septate............	5–13 × 2–3·5........	Mostly 6 10 · 2·2 3.
1-septate............	11–20 × 2·2–4.......	Mostly 13–19 × 2·5–3·5.
3-septate............	23–55 × 3–4·5.......	Mostly 28 46 × 3–4·4.
5-septate............	32–60 × 3–4·5.......	Mostly 40 54 × 3·5–4.
7-septate............	51–71 × 3–4·5.......	Average 59 × 3·7.

Chlamydospores numerous, terminal and intercalary, spherical to pyriform, 1–2-celled, also in short chains and small clusters, smooth or rugulose. Sporodochia and sclerotia wanting.

This variety is the cause of wilt in asters, (*Callistephus chinensis*), and occurs in all countries where asters are cultivated, except in those with comparatively low summer temperatures.

Hab. *Callistephus chinensis* Nees, from discoloured stems of wilting plants, Pretoria (Doidge, Wager, van der Merwe) M.H. 28437, and Durban (McClean and Anderson). Ten isolations were studied. The organism is probably widely distributed in the Union.

Growth on Standard Media.

Oat agar: Aerial mycelium sparse, white, cottony. Growth on substratum colourless, or becoming tinged light congo pink. The pink colour faded after 4 weeks, and was replaced by a tilleul buff or brownish tinge.

Hard potato agar: Aerial mycelium sparse, white, cottony, mostly at the top and bottom of the slant. Growth on substratum colourless. A thin pionnotes formed on the surface of the slant.

Standard synthetic agar plus starch: Aerial mycelium like that on hard potato agar. Growth on substratum colourless, or with a faint tinge of flesh pink; occasionally there was a tinge of dark vinaceous grey in the agar under the lower part of the slant. A thin pionnotes developed along the needle track.

Potato agar plus 5 per cent. dextrose: A moderate amount of aerial mycelium developed, especially on the lower half of the slant. Growth in the substratum was white, shining, or tinged light brown vinaceous and dark bluish grey green.

Potato plug: Plug covered with a vigorous, white, cottony mycelium.

Melilotus stem: Stems covered with a copious, white, cottony mycelium, or with a less vigorous growth which was tomentose to sericeo-tomentose and brownish white.

Bean pod : Pods covered with a fairly vigorous growth of white, cottony, aerial mycelium. It occasionally became tinged with yellow or with light pinkish cinnamon.

Rice : Growth white, or very faintly tinged sea-shell pink. Grains cream colour to cream buff.

FIG. 26.

Fusarium conglutinans Wr. v. *callistephi* Beach ; Conidia from thin pionnotes of (*a*) 8 weeks old culture on standard synthetic agar plus starch, (*b*) 2 weeks old culture on oat agar, (*c*) 4 weeks old culture on hard potato agar; chlamydospores from (*d*) 5 days old culture on plain agar and (*e*) 4 weeks old cultur eon hard potato agar.

Measurements of Conidia.

Oat agar, culture 2 weeks old, conidia from thin pionnotes.

5-septate............	2 per cent..........	32·5–52·5 × 3·5–4·5.
4-septate............	2 ,, ...	32·5–40 × 2·8–3·75.
3-septate............	28 ,, ...	22·5–45 × 2·8–3·75.
2-septate............	7 ,, ...	25–32 × 2·5–3.
1-septate............	6 ,, ...	10–27·5 × 2·5–3.
0-septate............	55 ,, ...	7·5–15 × 2–2·8.

Standard synthetic agar plus starch, culture 2 weeks old, conidia from thin pionnotes.

5-septate............	4·5 per cent........	55–80 × 3·7–4·5.
4-septate............	0·5 ,, ...	55–70 × 3·5–4.
3-septate............	2 ,, ...	10–67·5 × 3–4.
2-septate............	1·5 ,,	
1-septate............	3·5 ,,	
0-septate............	89 ,,	

Most of the conidia from the mycelium were non-septate, those which were 3- or more septate being only about 1 per cent. of the whole number. A few conidia with more numerous septations were observed amongst these, especially on hard potato agar and standard synthetic agar plus starch. The measurements of these were as follows.

6-septate..	50–75 × 3·7–4.
7-septate..............................	50–75 × 3·7–4·5.
8–11-septate..............................	55–75 × 3·7–4·5.

Chlamydospores numerous, thick-walled, rough; intercalary single and in pairs.7–9 μ diam.; terminal usually single, 7·5–12·5 μ diam.

Sub-section CONSTRICTUM.

Sporodochia and pionnotes present. Macroconidia elongated, slender, 3–3·7 μ diameter, rather more curved at the ends than at the middle, apex constricted, base pedicellate, 3–1 or 3-5-septate; the 3-septate 10–13 times, and the 5-septate 13–15 times as long as broad. Chlamydospores, sclerotia and sclerotial stromata as in sub-section *Orthocera.*

Fusarium Bulbigenum Cke. et Mass.

Cooke and Massee, Grevillea 16: 49, 1887. Wollenweber, Fusarium-Monographie, 411–412, 1931; Fus. aut. del. 367–370, 372, 374, 994, 995, 997, 999. Wollenweber and Reinking, Die Fusarien, 113–114, 1935.

Syn. *Fusarium cromyophthoron* Sid.;

F. loncheceras Sid.; *F. loncheceras* v. *microsporon* Sid.

F. rhizochromatistes Sid.; *F. rhizochromatistes* v. *microsclerotium* Sid.

F. laxum Peck; ? *F. equisetorum* (Lib.) Desm.; *Hymenula equiseti* Lib.

Stroma sometimes effuse, plectenchymatous, pale, or pink to violet red, covered with pinkish white or lilac, aerial mycelium; sometimes rugulose, sclerotially erumpent, and developing hard sclerotial bodies 0·5–5 mm. in diameter, which are from light brownish white or green to dark blue in colour. Conidia in sporodochia, on a flat or raised stroma, or formed directly on the substratum, or in a pionnotal layer: ochre to salmon colour in mass. Chlamydospores terminal or intercalary, single, 2-celled or in chains, 5–12 μ diam. Microconidia 1-celled, or with 1 or 2 septations; macrocondia 3–5-septate, elongated, subulate, straight or sub-falcate, tapering at both ends; somewhat constricted at the apex, and abruptly bent, or symmetrical and acute; base more or less pedicellate.

0-septate...........	5–12 × 2–3·5........	Mostly 7–9 × 2–3.
1-septate...........	11–33 × 2–3·7........	Mostly 13–20 × 2·3–3·2.
3-septate............	20–54 × 2·3–4.......	Mostly 34–44 × 2·7–3·9.
5-septate............	34–66 × 3–4·5.......	Mostly 45–56 × 3·2–3·9.

Hab. *Allium cepa* L., from bulb of wilting plant, Eikenhof, nr. Johannesburg, Oct. 1932, M.H. 28362.

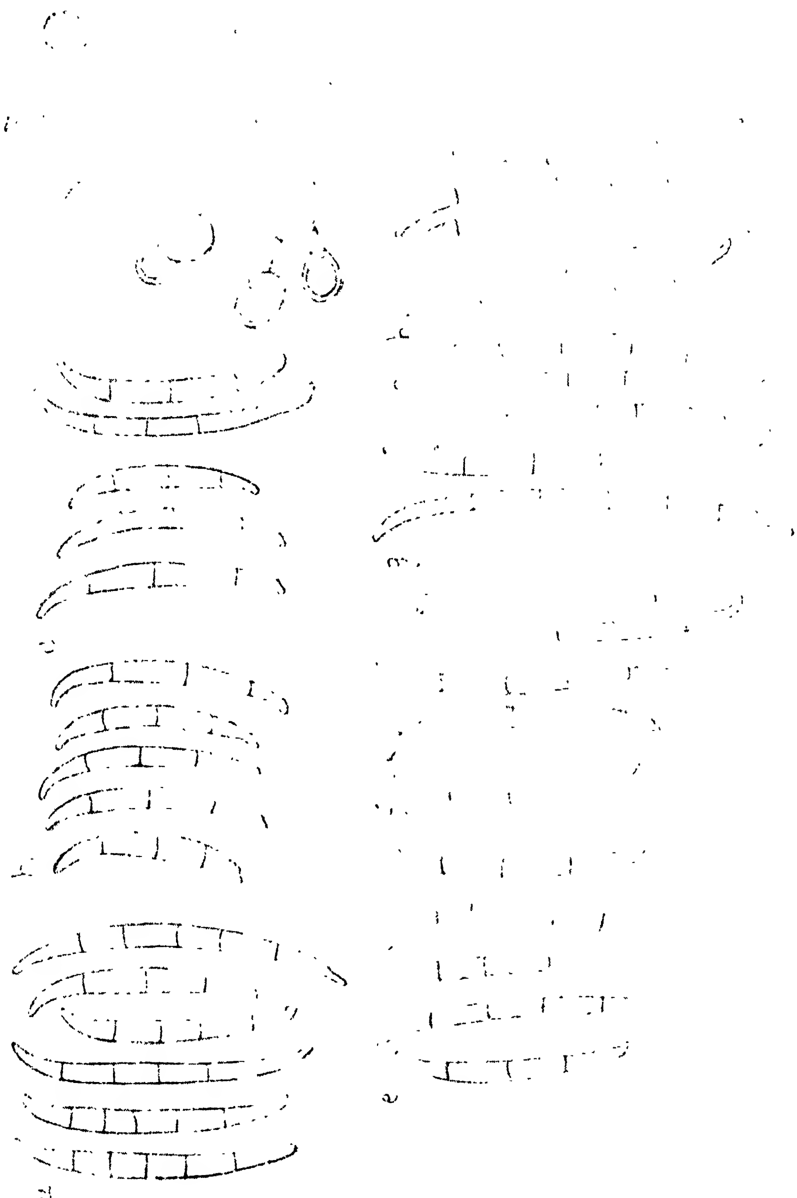

FIG. 27.

Fusarium bulbigenum Cke. et Mass.; (*a-d*) strain from onion, (*e-f*) strain from tobacco; conidia from sporodochia of (*a*) 10 weeks old culture on standard synthetic agar plus starch, (*b*) 4 weeks old culture on oat agar, (*c*) 8 weeks old culture on Melilotus stem, (*d*) chlamydospores from culture on hard potato agar, 8 weeks old; conidia on mycelium of culture (*e*) 8 weeks old on potato agar plus 5 per cent. dextrose, (*f*) 12 weeks old on standard synthetic agar plus starch, (*g*) 4 weeks old on Melilotus stem, and (*h*) 4 weeks old on oat agar.

Freesia refracta Klatt., from corms showing a form of dry rot, said to develop in storage, Pretoria, 1929.

Gladiolus sp., from corms of indigenous species of *Gladiolus* showing dry, brown form of rot when dug up in veld, Palmaryville, nr. Louis Trichardt, N. Transvaal (Koker).

Nicotiana tabacum L., from discoloured vascular tissues of stems and petioles of wilting tobacco plants (7 isolations), Rustenburg, Transvaal (Moore).

From soil; isolated from a soil sample by Dr. Kammerman, Division of Chemistry. This strain was extremely tolerant of copper sulphate; it grew in concentrations of 1/750 and 1/1000; growth was inhibited by 1/500.

Fusarium bulbigenum occurs in Europe, and less frequently in America on decaying bulbs, tubers, rhizomes, roots, stems, fruit, etc., chiefly on plants belonging to the Liliiflorae, but also on other hosts. It is also present in humus.

Growth on Standard Media.

Oat agar: Aerial mycelium sparse or plentiful: in the latter case it is dense, matted, white to vinaceous pink. Growth on substratum purplish vinaceous, or vinaceous purple to dull Indian purple. Very numerous, blue-black, rough, irregular sclerotial outgrowths appeared in some strains after 4 weeks, pushing through the aerial mycelium, and becoming more or less erect and stilboid. Groups of sporodochia developed on the stroma at the base of the tube: they were 2 3 mm. diam., and pale pinkish cinnamon.

Hard potato agar: Mycelium sparse to moderate in amount, white, tomentose or matted. Growth on substratum colourless. A few small sporodochia developed: they were light ochraceous salmon. A number of minute, blue-black sclerotia developed at the base of the slant.

Standard synthetic agar plus starch: Aerial mycelium short, sparse, tomentose. Growth on substratum coral pink to vinaceous pink, with groups of blue-black, erumpent, sclerotial bodies near the base of the slant; or growth in substratum anthracene purple to taupe brown, and the agar stained the same colour. Groups of pale pinkish cinnamon sporodochia developed after 5 weeks.

Potato agar plus 5 per cent. dextrose: Aerial mycelium rather dense, coarse, tomentose or matted, white to slate purple. Growth on substratum dark perilla purple and dark naphthalene violet, or almost black, and the agar stained the same colour.

Potato plug: Plugs covered with a dense mycelial growth, which was cottony to tomentose, and white to sea-shell pink. Very numerous blue-black sclerotial bodies developed after 5 weeks: these were scattered, or crowded and coalescent; in the latter case, they formed larger sclerotial masses up to 3·5 mm. diam. Sporodochia developed on the sclerotial masses.

Melilotus stem and bean pod: Medium covered with rather sparse mycelium, which was short and felt-like, or sericeo-tomentose, white to pinkish buff. Colourless sclerotial bodies developed in places, and on these the pale pinkish cinnamon sporodochia formed.

Rice: Mycelium fairly dense, white to flesh colour, venetian pink and old rose; mycelium on grains was often eugenia red to acajou red.

Measurements of Conidia.

A.—Strain from *Allium*.

Oat agar, culture 8 weeks old, conidia from sporodochia.

5-septate............	10 per cent	....	37·5–55 × 3·75–4·5.
4-septate............	39 ,,	....	30–47·5 × 3·5–4.
3-septate............	49 ,,	....	25–45 × 3–3·75.
1-septate............	1 ,,	....	10–18 × 2·5–3·5.
0-septate............	1 ,,	....	7–9 × 2–3.

Standard synthetic agar plus starch, culture 8 weeks old, conidia from sporodochia.

5-septate............	8 per cent........	37·5–50 × 3·7–4·5.
4-septate............	14·5 ,, ...	38–52 × 2·5–4·5.
3-septate............	77·5 ,, ...	30–49 × 2·5–3·75.

Melilotus stem, culture 8 weeks old, conidia from sporodochia.

4-septate............	4 per cent..........	27·5–42·5 × 3·5–4·5.
3-septate............	92 ,, ...	26–42·5 × 3·7–4·5.
0-septate............	4 ,,	

Chlamydospores formed freely on plain agar plates: they were terminal or intercalary smooth or verrucose, 5–10 μ diam.

B.—Strain from *Nicotiana*.

Hard potato agar, culture 8 weeks old, conidia from pionnotes.

7-septate............	Rare.................	42·5 × 4.
6-septate............	2 per cent........	42·5–47·5 × 3·7–4·25.
5-septate............	7 ,, ...	36–57·5 × 3–4·25.
4-septate............	12 ,, ...	37·5–47·5 × 3·5–4.
3-septate............	19 ,, ...	20–42·5 × 3–4.
2-septate............	0·6 ,, ...	22–25 × 2·5–3.
1-septate............	9 ,, ...	14–30 × 2·5–3·25.
0-septate............	50·5 ,, ...	7·5–12·5 × 2–3.

Oat agar, culture 6 weeks old, conidia from mycelium. Very few macroconidia, possibly 0·1 per cent. to 0·5 per cent.

6–7-septate............	75–80 × 4–4·5.
5-septate............	35–72·5 × 3–4·25.
4-septate............	30–70 × 3·5–4.
3-septate............	20–55 × 3–4 (about 50 per cent. of the macroconidia).
2-septate............	20–30 × 2·5–2·8.
1-septate............	15–27·5 × 2·5–2·8.

Standard synthetic agar plus starch, culture 10 weeks old, conidia from sporodochia.

8-septate............	1 per cent........	76–80 × 4–4·5.
7-septate............	1·5 ,, ...	72·5–75 × 4–4·5.
6-septate............	7 ,, ...	47·5–75 × 3·7–4·25.
5-septate............	58·5 ,, ...	40–75 × 3·5–4·25.
4-septate............	18·5 ,, ...	20–57·5 × 3·5–4·25.
3-septate............	10·5 ,, ...	19–48 × 3–4.
1-septate............	0·5 ,, ...	17·5 × 2·5.
0-septate............	2·5 ,,	

Melilotus stem, culture 6 weeks old, conidia from mycelium.

Very few macroconidia, about 0·1 per cent.: about 50 per cent. of these were 3-septate.

5-septate................................	45–77·5 × 2·8–4.
4-septate................................	45–65 × 2·5–4.
3-septate................................	28–55 × 2·8–3·75.
2-septate................................	25–32 × 2·5–2·8.
1-septate................................	15–22·5 × 2·5–3.

The conidia of the strain from tobacco seem to be longer on the average than those of typical *Fusarium bulbigenum*, and in sporodochia and pionnotes there were sometimes over 50 per cent. of 5-septate conidia. Chlamydospores mostly terminal, single or occasionally in pairs, 5–12 μ diam.

Should further study show that this fungus is a specific vascular parasite of tobacco, it may then be regarded as a distinct variety, but for the present it must be classified as *F. bulbigenum*.

Fusarium bulbigenum Cke. et Mass. var. **lycopersici** (Brushi) Wr. et Rkg.

Wollenweber and Reinking, Die Fusarien, 114–115, 1935. Wollenweber, Fusarium-Monographie, 412, 1931; Fus. aut. del. 393, 996, 998.

Syn. *Fusarium lycopersici* Brushi.

F. oxysporum Schl. *f. lycopersici* Roum.

F. oxysporum Schl. v. *lycopersici* Lindau.

F. oxysporum Schl. subsp. *lycopersici* Sacc.

F. bulbigenum Cke. et Mass. *f.* 1 Wr.

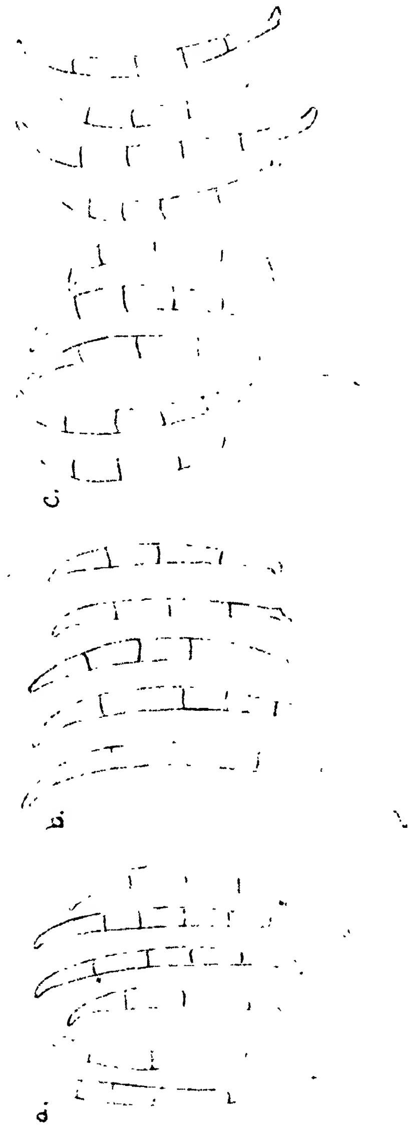

FIG. 28.

Fusarium bulbigenum Cke. et. Mass. v. *lycopersici* (Brushi) Wr. et. Rkg.; conidia from (*a*) pionnotes on 12 weeks old culture on standard synthetic agar plus starch, (*b*) pionnotes of 6 weeks old culture on hard potato agar, (*c*) sporodochia of oat agar culture, 6 weeks old.

This variety differs from the type in the absence of pigment in the sclerotially erumpent stroma, which never becomes blue. Aerial mycelium floccose, white or pinkish white. Plectenchymatous stroma violet red or pale; sclerotial stroma colourless, smooth, flat, later disappearing. Sporodochia minute, raised, often coalescing more or less to form a pionnotes; conidia in mass flesh pink to light orange. Microconidia 1-celled, or with 1–2-septations, produced freely on the aerial mycelium. Macroconidia 3–5-septate, seldom 6–7-septate.

0-septate............	8 × 2·5.	
1-septate............	18 × 2·8.	
3-septate............	25–66 × 2·3–4·3.....	Mostly 31–50 × 2·8–3·8.
5-septate............	32–68 × 2·8–4·5.....	Mostly 43–56 × 3·4.
7-septate............	50–70 × 3–4·5.......	Average 56 × 3·9.

Chlamydospores terminal and intercalary, typical.

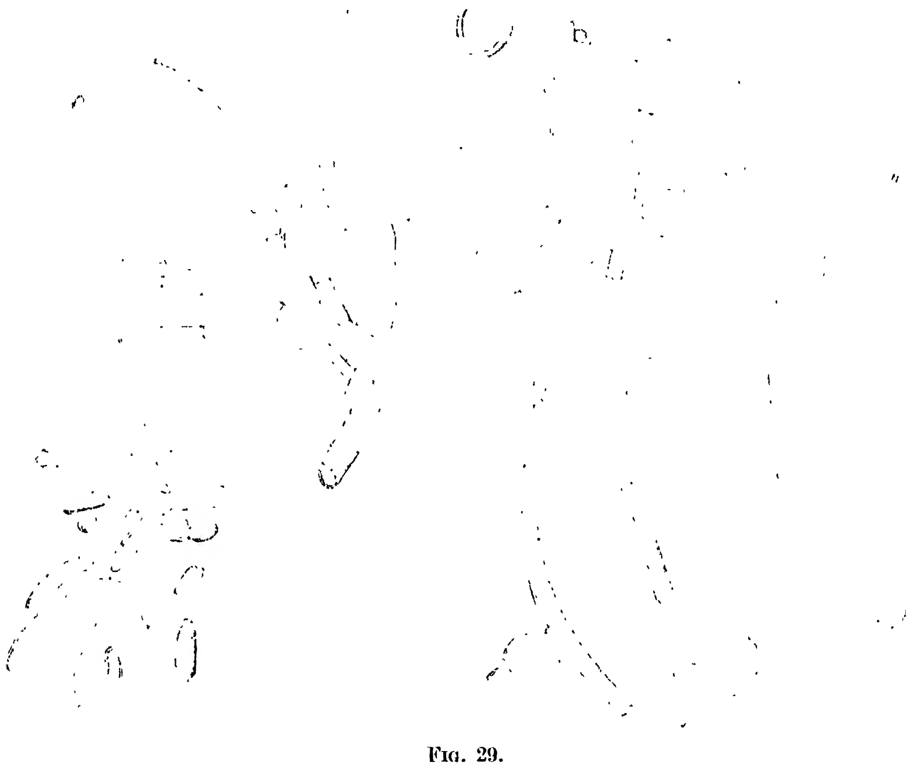

FIG. 29.

Fusarium bulbigenum Cke. et Mass. v. *lycopersici* (Brushi) Wr. et Rkg.; (*a*) part of branched conidiophore from sporodochium of culture on potato plug, (*b*) chlamydospores and (*c*) microconidia from 8 weeks old culture on standard synthetic agar plus starch.

Hab. *Lycopersicum esculentum* Mill., very common as a cause of wilt of tomato plants, especially in the Eastern Transvaal; numerous isolations studied from stems of wilting plants; Nelspruit, Karino and Boulders, E. Transvaal (Wager) M.H. 28428; from petioles of wilting plants, Gqaga, Transkei (Wager); from fruits taken from wilted plant, Duivelskloof, N. Transvaal (Wager); from seed offered for sale by local seedsmen (found in 5 samples; most of the seed used by commercial growers is imported from America).

Carica papaya L., from base of stem of plant affected by foot rot, Buffelspoort, Rustenburg Dist.

diam., occurring infrequently, and disappearing or becoming colourless when the organism has been growing for some time in culture. Microconidia 1-celled, or with 1–2-septa, straight or curved, formed freely in the aerial mycelium. Macroconidia in sporodochia and pionnotes, light red orange in mass, 3–5-septate, elongated, almost cylindrical to fusiform-falcate, tapering at both ends: apex somewhat constricted, abruptly bent or conical; base truncated, conical or pedicellate.

0-septate............	5–12 × 2–4·5........	Mostly 6·7–11 × 2·2–3·3.
1-septate............	10–24 × 2·5–5.......	Mostly 12–18 × 2·7–3.
3-septate............	24–50 × 2·4–7.......	Mostly 29–40 × 3·1–4.
5-septate............	40–66 × 3–5.........	Mostly 43–56 × 3·4–4·3.

Chlamydospores typical, terminal and intercalary, spherical or oval, smooth: in conidia 5–10 μ diam., or if 2-celled 12–15 × 7: in mycelium larger, 7–21 × 6–17, 2-celled 15–30 × 9–20.

Hab. *Citrullus vulgaris* Schrad., from stems of wilting plants, Witpoort, P.O. Halfway House, Pretoria dist., 1931–1937: Biesjesvlei, Lichtenburg, Dec. 1935: Uitenhage, Cape (Haines).

This organism is known as the cause of a vascular wilt of watermelons, and possibly also of musk melons and cucumbers in the United States and less frequently in Europe. Watermelon wilt and its causal organism cause serious losses in fields where watermelon is a commercial crop in parts of South Africa. The large number of strains isolated varied considerably in culture characters, and also in the degree of pathogenicity to the host.

Growth on Standard Media.

Oat agar: Aerial mycelium moderate in amount, cottony to tomentose, white or faintly tinged with the colour of the stroma. Growth on substratum colourless, or vinaceous lilac to anthracene purple; sometimes with a touch of eugenia red at the top of the slant.

Hard potato agar: Mycelium rather sparse to moderate, white, or tinged pale mauve to manganese violet. Growth on substratum colourless.

Standard synthetic agar plus starch: Aerial mycelium sparse, cottony to tomentose, white or tinged with the colour of the stroma. Growth on substratum colourless to Hay's lilac or dark perilla purple; in the latter case, the agar was stained dusky dull violet; occasionally there were patches of deep delft blue in the substratum.

Potato agar plus 5 per cent. dextrose: Mycelium moderate in amount, tomentose, white to brownish vinaceous, vinaceous lilac and deep purplish vinaceous. Growth on substratum colourless to slate purple and anthracene purple, sometimes with a line of slate violet at the base of the slant. Agar sometimes stained dusky dull violet.

Potato plug: Aerial mycelium copious, tomentose, or sparse, sericeo-tomentose, white to congo pink. Growth on substratum pale to flesh colour, with patches of slate violet between the medium and the glass. There was a line of deep delft blue at the base of the plug.

Melilotus stem and bean pod: Mycelium sparse to moderate, tomentose to sericeo-tomentose, white or tinged ochre.

Rice: Growth white to eugenia red and dark vinaceous or vinaceous lilac. Not aromatic.

Measurements of Conidia.

Six strains of this fungus were studied, but no conidial masses were observed in any of the cultures; macroconidia were produced in limited numbers on the mycelium, and their measurements fell within the limits indicated in the general description of the variety.

Sub-section OXYSPORUM.

Sporodochia and pionnotes present. Macroconidia comparatively stout, 3·7–4·7 μ thick, fusiform-falcate, curved, tapering gradually or abruptly at both ends, with rostrate, elongated or constricted apex, and more or less pedicellate base, 3- or 3–5-septate. The 3-septate conidia 7 times, and the 5-septate 9–10 times as long as broad. Chlamydospores 1-celled, 5–15 μ diam., 2-celled 10–14 × 4–8 μ. Sclerotia and sclerotial stromata pale, or green to blue-black.

Fusarium oxysporum Schlecht.

Schlechtendahl, Flora berol. 2: 139, 1824. Wollenweber, Fusarium-Monographie, 416–418, 1931; Fus. aut. del. 378, 379, 1004–1008, 1170–1174. Wollenweber and Reinking, Die Fusarien, 117–118, 1935.

Syn. *Fusarium candidulum* Sacc; *F. elegans* App. et Wr. (nom. nud.)
F. mycophilum Sacc.; *F. myosotidis* Cke.
F. opuntiarum Speg.; *F. trifolii* Jacz.

Fig. 31.

Fusarium oxysporum Schlecht.; conidia from sporodochia of culture on (*a*) Melilotus stem, 8 weeks old, (*b*) standard synthetic agar plus starch, 8 weeks old, (*c*) oat agar, 10 weeks old, (*d*) bean pod, 12 weeks old, (*e*) chlamydospores from 8 weeks old culture on Melilotus stem.

Stroma brownish-white to violet, plectenchymatous, smooth, effuse; or sclerotially erumpent and forming hard bodies, which are pale, or wood green to blue black, more or less rugulose, 0·5–3 or 3–6 mm. diam. When the fungus grows under more humid conditions, the stroma is usually covered with a filamentous aerial mycelium of medium height. Later sporodochia develop, or, less frequently, pionnotes. Conidia 3- (4–5)-septate, fusiform-falcate, curved or almost straight, definitely or weakly pedicellate. Microconidia 1–2-celled, oval to reniform, numerous, scattered in the mycelium, but lacking in typical sporodochia and pionnotes, which consist almost entirely of macroconidia.

0-septate............	5–15 × 2–4..........	Mostly 7–10 × 2·1–3.
1-septate............	10–26 × 2–4·5.......	Mostly 12–17 × 2·5–3·4.
3-septate............	19–45 × 2·5–5.......	Mostly 23–37 × 3–4·6.
5-septate............	30–60 × 3·5–5.......	Mostly 38–49 × 3·8–4·5.

Chlamydospores terminal and intercalary, in hyphae and conidia, spherical, smooth or rugulose, 1-celled, seldom 2-celled, 5–15 μ diam., sometimes larger in the mycelium (10–15). Hab. *Carica papaya* L., from stems of seedlings which were dying off, E. Transvaal (Wager) M.H. 28363.

Citrus sinensis Osbeck, from stem end rot and centre of fruit kept 12–18 weeks in storage; navel oranges from Sunday's River, and Groot Drakenstein, Cape, M.H. 28353, 28354 and 28351; and from White River, Transvaal; also from Valencia oranges, from Sunday's River and White River.

Coffea robusta L., from base of stem of plants which were not thriving, Hartebeestpoort, Transvaal (Koch) M.H. 28363.

Ipomoea batatas Lam., from tubers showing superficial, sunken, dry, discoloured areas, Humansdorp, Cape (Wager).

Lathyrus odoratus L., from decaying stems of seedlings, Brooklyn, Pretoria (Doidge).

Solanum tuberosum L., from tubers showing dry rot and wrinkling of stem end, Stampriet fontein, Windhoek, S.W.A.: Pretoria and Klerksdorp, Transvaal; Port Elizabeth, Cape; also in a consignment of potatoes from Hamburg, Germany: from tubers showing a soft type of rot, Mokeetsi, N. Transvaal, May 1931 (Wager): also reported by du Plessis (13) to have been isolated from potatoes from Paarl and Stellenbosch, Western Cape.

As defined by Wollenweber and Reinking (loc. cit.), this is a ubiquitous species, not a specific potato parasite, but occurring on an extensive range of hosts. It is known as a cause of rot of fruits, bulbs and tubers, but further investigations are necessary to determine its economic importance. It varies in the presence or absence of blue colouring in the sclerotial plectenchyma, and may, or may not produce on rice media a weak or strong aromatic odour, reminiscent of lilac. Morphologically the species is fairly constant with regard to the size, form and septation of conidia.

Growth on Standard Media.

Oat agar: Aerial mycelium very sparse. Growth on substratum tinged pale lilac to vinaceous purple. A few blue-black sclerotial masses, 2–5 mm. diam., formed near the base of the slant in some strains. Groups of sporodochia developed slowly. There was a pionnotal layer along the needle track after 14 days, but groups of sporodochia were not fully developed until after 4 weeks growth; they were pale to light vinaceous cinnamon, or shell pink to vinaceous pink.

Hard potato agar: A little sparse, white, arachnoid mycelium covered the slant. Growth on substratum colourless. Sporodochia small, cream colour to pale pinkish cinnamon. In one set of cultures, a few small sclerotia developed at the base of the slant.

Standard synthetic agar plus starch: Aerial mycelium very sparse, short and patchy, or wanting. Growth on substratum vinaceous pink to vinaceous lavender, later tinged slate purple. A few groups of small sporodochia developed, and somtimes coalesced along the needle track, to form a continuous pionnotal layer. Conidial masses were sea-shell pink to salmon buff or vinaceous pink. In some cultures one or two sclerotia formed at the base of the slant.

Potato agar plus 5 per cent. dextrose: Slant covered with a moderate growth of aerial mycelium, which was cottony or matted, felt-like, and becoming wrinkled; it was white to pale lilac and vinaceous lavender. Growth on substratum purplish vinaceous or dull Indian purple, sometimes becoming blue-black. The agar was often stained clove brown to almost black.

Potato plug: Plugs covered with a vigorous growth of cottony aerial mycelium, which sometimes became felt-like and wrinkled; mycelium white, tinged in places with light perilla purple. Sclerotial bodies very numerous, rough, minute to 5 mm. diam., at first pale, usually becoming blue-black: some strains produced no sclerotia on potato. Sporodochia vinaceous pink to light ochraceous salmon, developing in large groups; individual sporodochia 1–2 mm. diam.

Melilotus stem : Growth rather slow ; after 14 days, stems were covered with a short, close, white mycelium. Sclerotia mostly small, or up to 2·5 mm. diam., few or numerous, scattered, remaining pale or becoming blue-black. Sporodochia began to develop after 14 days ; they were 0·5–2 mm. in diameter, light pinkish cinnamon to light ochraceous salmon.

Bean pod : The pods were covered with a rather thin white mycelium, with scattered opaque spots, or with a heavier growth of white cottony mycelium. Groups of sporodochia were developing after 14 days ; they were pinkish buff to light pinkish cinnamon and light ochraceous cinnamon. In some cultures there were numerous, minute, scattered, blue-black sclerotia.

Rice : Growth at first white to flesh pink, or laelia pink to tourmaline pink ; after 14 days, it was white to old rose, and in 4 weeks patches of slate purple sometimes developed. There were colourless masses of plectenchyma between the medium and the glass. Cultures were faintly or strongly aromatic.

Measurements of Conidia.

Oat agar. culture 2 weeks old, conidia from sporodochia.

5-septate............	1·5 per cent........	50–52·5 × 3·8–5.
4-septate............	5 ,, ...	42·5–52·5 × 4–4·5
3-septate............	89 ,, ...	20–47·5 × 3·7–4·5
2-septate............	1·5 ,, ...	20–22·5 × 3·7.
1-septate............	0·5 ,, ...	12–18 × 2·5–3·5.
0-septate............	2·5 ,, ...	5–7·5 × 2·3.

Hard potato agar, culture 4 weeks old, conidia from pionnotes.

3-septate............	99 per cent..........	22–37·5 × 4–4·7.
2-septate............	1 ,,	

Bean pod, culture 4 weeks old, conidia from sporodochia.

3-septate............	98 per cent..........	22·5–37·5 × 3–5.
2-septate............		
1-septate............		

Bean pod, culture 2 weeks old, conidia from sporodochia.

5-septate............	1·5 per cent........	42·5–47·5 × 4–4·5.
4-septate............	5·5 ,, ...	37·5–47·5 × 3·7–4·5.
3-septate............	39·5 ,, ...	30–45 × 3·7–4·5.
2-septate............	0·5 ,,	
1-septate............	1 ,,	
0-septate............	52 ,,	

Melilotus stem, culture 2 weeks old, conidia from sporodochia.

4-septate............	0·5 per cent........	33–45 × 4–4·5.
3-septate............	95·5 ,, ...	22·5–45 × 3–4·5.
2-septare............	0·5 ,,	
0-septate............	3·5 ,,	

Fusarium oxysporum Schl. *f.* 1 Wr.

Wollenweber, Fusarium-Monographie, 418, 1931 ; Fus. aut. del. 379, 391. Wollenweber and Reinking, Die Fusarien, 119, 1935.

Syn. *Fusarium euoxysporum* Wr. ; *F. oxysporum* aut. pr. p.

? *F. redolens* Wr. v. *angustius* Lindfors.

This is a form of *F. oxysporum* which is a specfic parasite of potato (*Solanum tuberosum*), causing wilt.

Conidia 0-septate..............	5–15 × 2–4.........	Mostly 7–10 × 2·1–3.
1-septate..............	10–26 × 2–4·5.......	Mostly 12–17 × 2·5–3·4.
3-septate..............	19–46 × 2·5–5.......	Mostly 23–40 × 3–4·6.
5-septate..............	30–60 × 3–6.........	Mostly 38–49 × 3·8–5.

Macroconidia in sporodochia mostly 3-septate, seldom 4–5-septate. Microconidia produce freely in the aerial mycelium. Stroma effuse, smooth, or sclerotially erumpent, pale to green or blue-black. Cultures on rice usually aromatic. Chlamydospores typical.
Hab. *Solanum tuberosum* L., from stems of wilting plants, which showed more or less typical blackening of vascular tissues and of the vascular ring in the tubers: Northern Transvaal, April 1932: Schietfontein, De Wildt, Transvaal (Wager): Louis Trichardt, N. Transvaal (Wager): Mbabane, Swaziland, 1931 (Wager): Moorddrift and Planknek, Potgietersrust, Transvaal, March 1932.

Also reported by du Plessis (13) from stem of wilting plant, Darling, Cape.

Fusarium oxysporum f. 1 is a cause of potato wilt in North America, Asia and Africa, comparatively rarely in Europe. Cultural characters and measurements of conidia closely resemble those of *F. oxysporum*.

Fusarium oxysporum Schl. var. **nicotianae** Johns.

Johnson, Jour. Agric. Res. 20: 515–535, 1921. Wollenweber and Reinking, Die Fusarien, 120, 1925. Wollenweber, Fus. aut. del. 625.

Syn. *Fusarium nicotianae* Oud.; *F. tabacivorum* Del.
F. oxysporum Schl. *f.* 5 Wr.

FIG. 32.

Fusarium oxysporum Schl. v. *nicotianae* Johns.; (*a*) conidia from sporodochia of 8 weeks old culture on Melilotus stem, (*b*) chlamydospores from the same culture.

This form has rather longer conidia than *F. oxysporum f.* 1 and *f.* 2, and is a specific parasite of the tobacco plant. Microconidia numerous, 1-celled or occasionally 1–2-septate. Macroconidia in sporodochia and sometimes in pionnotes, 3-septate, less frequently 4–5-septate; 3-septate 35 × 4·2: 5-septate 44·3 × 4. Chlamydospores 6–10·2 (av. 8·2). Sclerotia blue-black, comparatively numerous. Fungus not aromatic.
Hab. *Nicotiana tabacum* L., from plants affected at the collar, and showing discoloration of the vascular tissues for some distance up the stem, Buffelspoort, Rustenburg Dist. (Moore).

This variety is a cause of tobacco wilt in North America and probably also in Asia, Africa and Europe.

Growth on Standard Media.

Oat agar: Aerial mycelium moderate, cottony to tomentose, white to pale lilac. Growth in substratum pale lilac to vivid purple, colour fading with age. Sclerotial bodies developed later, especially near the base of the slant. After 4 weeks, small sporodochia appeared; they were light ochraceous salmon.

Hard potato agar: Aerial mycelium moderate, cottony; growth on substratum colourless.

Standard synthetic agar plus starch : Aerial mycelium moderate, cottony. Growth on substratum colourless at first ; in older cultures stroma and agar tinged dark purple drab. Sclerotial bodies present.

Potato agar plus 5 per cent. dextrose : Aerial mycelium fairly abundant, tomentose, white to pale lilac. Growth on substratum at first pale lilac, with a line of naphthalene violet at the base of the slant ; later naphthalene violet, and the agar tinged with the colour of the stroma. A few light ochraceous salmon conidial masses developed on tufts of mycelium.

Potato plug : Plug covered with a dense mycelial growth, which was cottony, with a tendency to become wrinkled and felt-like, white tinged with pale lilac in places. There were patches of blue-black on the substratum, and in older cultures, numerous, large, erumpent sclerotial masses developed ; these were at first pale, then blue-black.

Melilotus stem : Mycelium thin, white or tinged purplish lilac. After some weeks, a few irregular sclerotial outgrowths developed from the stroma, and there were a few small sporodochia, which were light ochraceous salmon to light pinkish cinnamon.

Bean pod : Pod became covered with a scant to moderate mycelial growth, which was white, cottony to sericeo-tomentose, and sometimes mealy-looking, owing to the presence of numerous conidia.

Rice : Growth white to purplish lilac at first. In older cultures the superficial mycelium was white and growth on substratum dull bluish violet to dark hyssop violet and vinaceous lilac. The culture was not aromatic.

Measurements of Conidia.

Melilotus stem, culture 8 weeks old, conidia from sporodochia.

5-septate	Few	35–45 × 4–5.
4-septate	2 per cent	32·5–42·5 × 3·7–5.
3-septate	91 ,,	22·5–42·5 × 3–4·5.
1-septate	2 ,,	
0-septate	5 ,,	

Potato agar plus 5 per cent. dextrose, culture 8 weeks old, conidia from sporodochia.

5-septate	2·5 per cent	40–48 × 4–5.
4-septate	30 ,,	37·5–46·5 × 4–5.
3-septate	61 ,,	30–42·5 × 3·7–5.
1-septate	1 ,,	
0-septate	5·5 ,,	

Fusarium oxysporum Schl. **f. 7** Wr.

Wollenweber and Reinking, Die Fusarien, 120–121, 1935. Wollenweber, Fus. aut. del. 1176.

Syn. ***Fusarium cepae*** Hanz.

F. cepae Hanz. emend. Link et Bailey.

This form is a parasite of onion (*Allium*) ; it does not attack potato, nor is f. 1 parasitic on onion ; 3-septate conidia are 33–36 × 3·8–4·5, and 5-septate 44 × 3·9 ; 6-septate conidia rare, 52 × 3·3.

Hab. *Allium cepa* L., from young plants dying off in seed beds, Pyramids, Pretoria Dist., March 1932 (Mogg) M.H. 28393 ; from bulbs and leaf bases, Nelspruit (Wager) M.H. 28433.

Also reported by du Plessis (12), as occurring in the winter rainfall area, and causing pink root and bulb of onions, Caledon, Ceres, the Peninsula, Franschhoek, Riversdale, Stellenbosch and Tulbagh.

Growth on Standard Media.

In culture, this form does not differ materially from *F. oxysporum.* Sporodochia salmon-buff to salmon colour. Sclerotial masses on potato small, numerous, dark bluish

grey green to dark delft blue. Chlamydospores numerous, in mycelium and conidia, mostly 1–2-celled, terminal and intercalary; 1-celled 5–6·5 μ diameter. Rice cultures faintly aromatic.

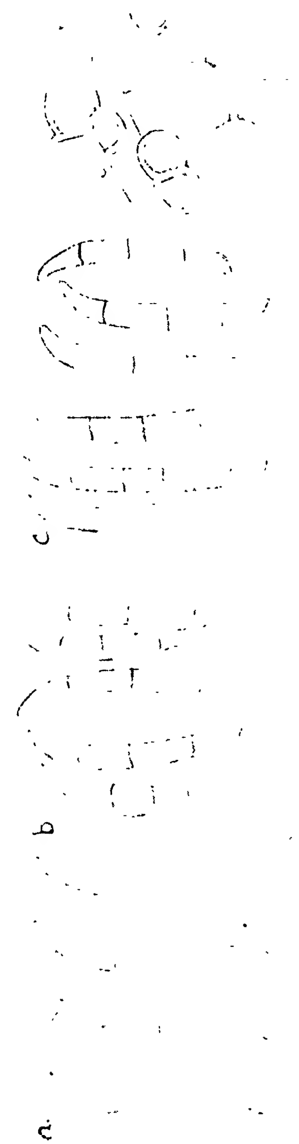

FIG. 33.

Fusarium oxysporum Schl. *f*.7 Wr.; conidia from sporodochia of 4 weeks old culture on (*a*) oat agar, (*b*) Melilotus stem, (*c*) potato plug, (*d*) chlamydospores from culture on oat agar, 4 weeks old.

Measurements of Conidia.

Oat agar, culture 4 weeks old, conidia from sporodochia.		
5-septate	0·5 per cent	37·5–42·5 × 3·7–5.
4-septate	3·5	31–50 × 3·5.
3-septate	41	22·5–46·5 × 3–4.
1-septate	3·5	10–18 × 2·5–3·25.
0-septate	51·5	7·6–10·5 × 1·8–3.
Potato, culture 4 weeks old, conidia from sporodochia.		
5-septate	0·5 per cent	37·5–55 × 3–4·7.
4-septate	4	32·5–45 × 3–4·4.
3-septate	91	20–42·5 × 3–4·5.
1-septate	1	10–15 × 2·5–4.
0-septate	3·5	8–10 × 2–3.
Melilotus stem, culture 4 weeks old, conidia from sporodochia.		
5-septate	0·5 per cent	40–44 × 3·7–5.
4-septate	5	35–47·5 × 3·7–4·7.
3-septate	94·5	22·5–45 × 3–4·7.

Fusarium oxysporum Schl. **f. 8** Snyder.

Snyder and Walker. Fusarium near-wilt of pea. Zentralbl. f. Bakt. II Abt. 91: 355–378. 1935. Wollenweber and Reinking. Die Fusarien. 121. 1935.

Syn. *Fusarium vasinfectum* Atk. v. *pisi* van Hall.

FIG. 34.

Fusarium oxysporum Schl. *f.* 8 Snyder: Conidia from pionnotes of 2 weeks old culture on (*a*) bean pod, *b*) hard potato agar, and (*c*) oat agar.

Conidia in sporodochia and pionnotes, 3-septate, less frequently 4–5-septate, exceptionally 6–7-septate; smaller 1–2-septate conidia are also found, and numerous microconidia scattered in the mycelium.

3-septate	25–59 × 2·8–5	Mostly 32–38 × 3·8–4·3.
5-septate	35–71 × 3·4–5	Mostly 35–50 × 4–4·3.

Sclerotia and sclerotial bodies occur, they are 0·5–2·5 mm. diameter, blue, green or pale. Chlamydospores 4–14 μ diameter.

Hab. *Pisum sativum* L., ? from stems of wilting pea plants, Tygerpoort, Pretoria Dist., (Fourie).

F. oxysporum f. 8 is parasitic on peas (*Pisum*), causing the disease known as "St. John's wilt" in Europe, and "near wilt" in the United States. An organism apparently identical with this form was obtained in pure culture from a number of wilting pea plants from Tygerpoort, but the identity of the South African fungus with *F. oxysporum f.* 8 needs confirmation by inoculation.

Growth on Standard Media.

In culture *f.* 8 resembles *F. oxysporum*, and is just as variable in the pigmentation of the stroma, and in the presence or absence of dark blue or pale sclerotia The presence of an aromatic odour in rice cultures is also variable.

Measurements of Conidia.

Oat agar, culture 2 weeks old, conidia from pionnotes.

5-septate............	2 per cent........	42·5–50 × 3·7–4·7.
4-septate............	11 ,, ...	37·5–47·5 × 4·4.
3-septate............	34 ,, ...	27·5–50 × 3·7–4·7.
1-septate............	0·5 ,,	
0-septate............	52·5 ,,	

Hard potato agar, culture 2 weeks old, conidia from pionnotes.

9-septate............	Only one seen........	72·5 × 3·75.
5-septate............	8 per cent........	47·5–57·5 × 3·75–5.
4-septate............	12·5 ,, ...	40–52·5 × 3·7–4·4.
3-septate............	66·5 ,, ...	25–60 × 3·5–4·5.
2-septate............	3 per cent.	
1-septate............	6 ,,	
0-septate............	4 ,,	

Bean pod, culture 2 weeks old, conidia from pionnotes.

5-septate............	Rare................	52·5 × 4·4.
4-septate............	2 per cent..........	36–50 × 4–4·7.
3-septate............	86 ,, ...	27·5–45 × 3·5–4·5.
0-septate............	12 ,,	

Fusarium oxysporum Schl. var. **aurantiacum** (Lk.) Wr.

Wollenweber, Fusarium-Monographie, 420–422, 1931; Fus. aut. del. 381–386, 627, 1013–1016, 1185–1187. Wollenweber and Reinking, Die Fusarien, 121–122, 1935.

Syn. *Fusarium aurantiacum* (Lk.) Sacc; *F. calcareum* (Thuem.) Sacc.
F. elongatum Pratt; *F. Peckii* Sacc. pr. p.
F. Saccardoanum Syd.; *F. sclerodermatis* Peck.
F. sclerotioides Sherb.

This variety has somewhat larger 3–5-septate conidia than the type, and a larger proportion of 4–5-septate conidia. Sclerotial bodies are sometimes 1–3 mm. diam., and sometimes more extensive, 4–6–12 mm. On rice the stroma is a deeper purple violet than in cultures of *F. oxysporum*, and is sometimes almost chestnut brown. Rice cultures are not aromatic.

0-septate............	5·5–9·5 × 2·2–2·7...	Average 7·2 × 2·6.
1-septate............	12–17 × 2·5–3·8.....	Average 14 × 3·1.
3-septate............	23–48 × 3–5·5......	Mostly 30–42 × 3·5–4·8.
5-septate............	33–70 × 3–5·5......	Mostly 38–57 × 3·8–4·7.
7-septate............	36–75 × 3·3–4·5.....	Mostly 41–65 × 3·7–4·6.

Chlamydospores more or less common, spherical to oval, 8·5 × 8 (5–12 diam.), 2-celled 11–14 × 7–9 (average 13·5 × 8).

Hab. *Antirrhinum majus* L., from stems of wilting plants, Johannesburg (Wager).

Arachis hypogaea L., from pods showing a pink discolouration of the shell, University Farm, Pretoria (F. du Toit).

Brassica oleracea L., from stems of wilting seedlings, Witpoortjie, Krugersdorp Dist.; also on half grown plants showing symptoms similar to those of "yellows."

Cupressus lusitanica Mill., from stems of dying seedlings, Xumeni Forest, Donnybrook, Natal, M.H. 28388.

Phaseolus sp. from stems of wilted plants, Nelspruit, E. Transvaal (Wager), and from Swaziland.

Pinus longifolia Roxb., from dying seedlings, N. Transvaal (Bottomley).

Pinus palustris Mill. and *P. taeda*, from stems of dying seedlings, Dukduku plantation, St. Lucia Bay, Zululand.

This fungus occurs in Europe, Asia and America. It is a saprophyte on decaying parts of plants, and is parasitic on conifer and cyclamen seedlings.

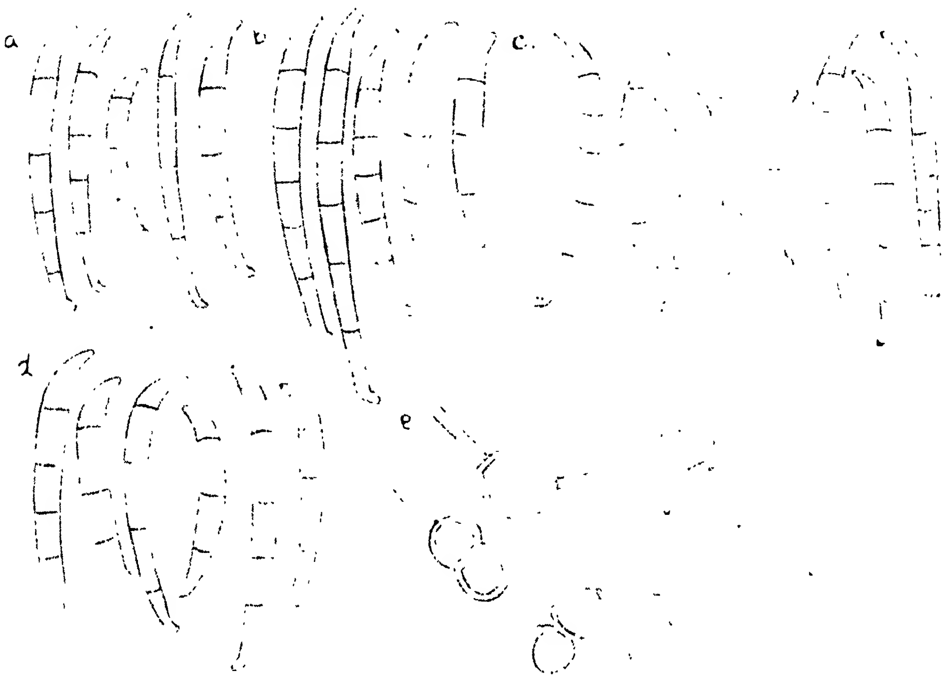

FIG. 35.

Fusarium oxysporum Schl. v. *aurantiacum* (Lk.) Wr.: conidia from (*a*) sporodochia of culture on Melilotus stem, (*b*) pionnotes on hard potato agar, (*c*) pionnotes on standard synthetic agar plus starch, (*d*) sporocochia of culture on oat agar; all cultures 2 weeks old: (*e*) chlamydospores from a 4 weeks old culture on hard potato agar.

Growth on Standard Media.

Oat agar: Aerial mycelium sparse or moderate in amount, cottony or matted, white to pale flesh colour, or tinged pinkish vinaceous near the substratum. Growth on substratum purplish vinaceous. Large, irregular, wart-like sclerotial masses developed, especially near the base of the slant; they were up to 5 mm. diam., and were at first colourless, then tinged with green, and finally blue-black. Sporodochia developed in groups, and were often coalescent, forming a continuous pionnotal layer; conidia in mass were light pinkish cinnamon to ochraceous salmon.

Hard potato agar: Aerial mycelium sparse, white, cottony; growth on substratum colourless. Numerous minute sporodochia developed, which soon ran together and formed a continuous pionnotes. A few minute sclerotia appeared at the base of the slant.

Standard synthetic agar plus starch: Aerial mycelium very sparse. Growth on substratum deep vinaceous lavender, and after 8 weeks, the agar was stained light russet vinaceous. Pionnotes developed freely, buff pink.

Potato agar plus 5 per cent. dextrose : Aerial mycelium fairly plentiful, cottony or matted, hite to pale vinaceous lilac. Growth on substratum dull Indian purple to dark slate ırple. After 4 weeks, the agar was stained brown to almost black. Numerous deep delft ue sclerotia were present after 4 weeks.

Potato plug : Plug covered with a dense mycelial growth, which was white to pale ac, cottony or becoming felt-like and wrinkled. Sclerotial masses at first small and pale, ·coming bluish-green and finally blue-black and developing into irregular, raised, rough asses, up to 5 mm. or occasionally 10 mm. in diameter. A few sporodochia developed ; ey were pale pinkish cinnamon.

Melilotus stem : Aerial mycelium rather thin, white to shell pink. Stems became vered with numerous sclerotial masses, which were 1–3 mm. diam., at first pale, then eenish blue, and finally blue-black. A few sporodochia developed.

Bean pod : Mycelium rather thin, or moderate in amount. Pinkish cinnamon sporo- ·chia developed in 14 days ; they were small, scattered or in groups. A few minute, blue- ıck sclerotia were present.

Rice : Growth white to alizarine pink, venetian pink and old rose, becoming acajou l and pompeian red in places. Masses of plectenchyma developed between the medium d the glass. Not aromatic.

Measurements of Conidia.

Hard potato agar, culture 14 days old, conidia from pionnotes.

6-7-septate	2 per cent........	35 55 × 4 5.
5-septate	8 ,, ...	36–55 × 3·7–4·7.
4-septate	23 ,, ...	35-55 × 3-4·5.
3-septate	66·5 ,, ...	37·5–45 × 3·7–5.
2-septate	0·5 ,, ...	22·5-40 × 3·7 5.
0-septate	1 ,,	

Bean pod, culture 14 days old, conidia from sporodochia.

5-septate	3·5 per cent........	35–54 × 3·5 5.
4-septate	13 ,, ...	32·5-50 × 3·5–5.
3-septate	80 ,, ...	27–45 × 3·3 5.
2-septate	1 ,, ...	20-30 × 3·7-4.
1-septate	1·5 ,,	
0-septate	1 ,,	

Oat agar, culture 2 weeks old, conidia from sporodochia.

5-septate	1 per cent..........	42·5 60 × 3·7-4.
4-septate	17 ,, ...	37·5–57·5 × 3·3-5.
3-septate	82 ,, ...	27·5–50 × 3·3–4·5.

Standard synthetic agar plus starch, culture 2 weeks old, conidia from sporodochia

5-septate	10 per cent........	45-57·5 × 3·7 5.
4-septate	37 ,, ...	42·5–55 × 3·5-5.
3-septate	52 ,, ...	30-50 × 3·5-4·5.
1-septate	0·5 ,,	
0-septate	0·5 ,,	

Fusarium oxysporum Schl. var. **gladioli** Massey.

sey, Fusarium rot of Gladiolus corms, Phytopathology 16; 509–523, 1926. Wollenweber and ıking, Die Fusarien, 122-123, 1935. Wollenweber, Fus. aut. del. 1183, 1184.

The conidia of this variety are broader than those of the type, and in this respect ›roach in form those of var. *aurantiacum*. Conidia, measure :—

0-septate	6 × 2·7.	
1-septate	13 × 3·2.	
3-septate	25–41 × 3·5–4·8.....	Average 33·4 × 4·3.
5-septate	42–46 × 4·3–4·6.....	Average 44 × 4·5.
7-septate	40–44 × 4·8.........	Average 42 × 4·8.

The macroconidia are produced in salmon-orange sporodochia, which are up to 2 mm. diameter; they are 3–4-septate, less frequently 5-septate, or exceptionally up to 7-septate. Chlamydospores spherical, smooth, terminal or intercalary, mostly 1-celled; chlamydospores in or on the conidia are smaller (6–14 × 5–10) than those arising in the mycelium (7–17 × 7–10). The aerial mycelium is floccose, well developed, white, and up to 5 mm. high. Dark blue sclerotia are present and numerous.

Hab. *Gladiolus* sp., from corms and leaf bases, Princess Park, Pretoria.

The younger leaves turned brown, and plants failed to flower; corms were still firm but were discoloured brown, especially near the base. The identity of the organism with *F. oxysporum* v. *gladioli* needs confirmation by inoculation into healthy plants. Variety *gladioli* is the cause of decay of *Gladiolus* corms in North America and Australia.

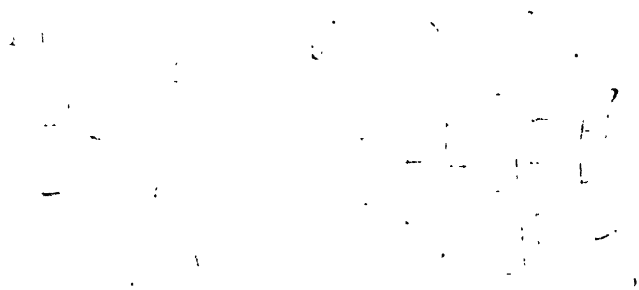

FIG. 36.

Fusarium oxysporum Schl. v. *gladioli* Mass.; conidia from pionnotes of 2 weeks old cultures on (*a*) oat agar, (*b*) hard potato agar.

Growth on Standard Media.

In culture, the *Gladiolus* organism did not differ materially from *F. oxysporum*.

Measurements of Conidia.

Melilotus stem, culture 4 week old, conidia from sporodochia.

3-septate	51 per cent	20–37·5 × 3·7–4·7.
2-septate	8 ,,	15–26·5 × 3–3·5.
1-septate	2·5 ,,	12·5–18 × 3–3·5.
0-septate	33 ,,	4–11 × 2·5–4.

Standard synthetic agar plus starch, culture 12 weeks old, conidia from sporodochia.

6-septate	0·5 per cent	43 × 4·7.
5-septate	4·5 ,,	40–45 × 4–4·7.
4-septate	17 ,,	40–42 × 4–4·7.
3-septate	48 ,,	28–42 × 3·5–4·7.
2-septate	4 ,,	15–25 × 3–3·4.
1-septate	2 ,,	15–20 × 3–3·5.
0-septate	24 ,,	6–10 × 2·5–3.

Fusarium dianthi Prill. et Del.

Delacroix, La maladie des oeillets d'Antibes, Ann. Inst. Agron. Nancy, 16: 1901. Wollenweber and Reinking, Die Fusarien, 123–124, 1935. Wollenweber, Fus. aut. del. 1188–1189.

The conidia occur in light orange, sporodochial and pionnotal masses; they are fusiform-falcate, pedicellate, often abruptly bent at the constricted apex, and a little thicker

the upper third than in the middle, definitely dorsiventral, mostly 3– or 3–5-septate, ceptionally 1–2- or 6–8-septate. Microconidia numerous, 1-celled, or with 1–2-septations, attered in the floccose aerial mycelium, which is white to pink.

0-septate............	5–15 × 1·5–4·5......	Mostly 7–11 × 2–3·6.
1-septate............	10–30 × 2–4.........	Mostly 15–21 × 2·4–3·3.
3-septate............	16–63 × 2·5–4.......	Mostly 23–52 × 3·1–4·5.
5-septate............	30–80 × 3–5·5.......	Mostly 37–69 × 3·6–5.
7–9-septate............	70–100 × 3·8–4.	

The more compact 3-septate conidia average 31 × 4·3, the more slender 37 × 3·7. lamydospores round, smooth or rough, 6–12 (av. 8·1), 2-celled ellipsoid-oval, 13–16 × 13. The fungus is not aromatic.

Hab. *Dianthus caryophyllus* L., from stems of wilting plants, Bethlehem, O.F.S.; im and Politsi, N. Transvaal: Durban, Natal; Golden Valley, Cape.

a. b.

FIG. 37.

Fusarium dianthi Prill. et Del.; conidia from sporodochia of 8 weeks old cultures on (*a*) potato agar + 5 per cent. dextrose, (*b*) oat agar.

Growth on Standard Media.

In culture, the strains studied closely resembled *F. oxysporum* var. *aurantiacum*.

Measurements of Conidia.

Oat agar, culture 8 weeks old, conidia from sporodochia.

6-septate............	0·5 per cent........	38–57 × 4·5–5.
5-septate............	2 ,, ...	40–60 × 4–5.
4-septate............	4 ,, ...	35–52 × 3–4·5.
3-septate............	89 ,, ...	23–45 × 3–4·5.
1-septate............	0·5 ,, ...	16–20 × 2·5–3.
0-septate............	4 ,, ...	6–12 × 2–3·4.

Potato agar plus 5 per cent. dextrose, culture 8 weeks old, conidia from sporodochia.

3-septate....................................	25–40 × 3–4·5.
2-septate....................................	20–30 × 3·5–4.
1-septate....................................	15–24 × 3–3·75.

Fusarium vasinfectum Atk.

Atkinson, Some diseases of cotton, Agric. Exp. Sta. Alabama, Bull. 41; 19, 1892. Wollenweber, rium-Monographie, 423, 1931; Fus. aut. del. 376. Wollenweber and Reinking, Die Fusarien, 1935.

Fusarium malvacearum Taub.

Differs from *F. oxysporum* in the somewhat narrower conidia, the free development ionnotes, the comparatively small, green to blue sclerotial plectenchyma (0·1–2 mm. n.), and the purple-red plectenchymatous stromata. Microconidia 1-celled, or with one

or two septations, scattered. Macroconidia in sporodochia and pionnotes, isabellinous to light salmon orange in mass; fusiform-falcate, somewhat constricted, tapering or rostrate at both ends, base pedicellate or papillate.

0-septate............	4–12 × 2–3..........	Mostly 6·7–9·5 × 2·3–2·8.
1-septate............	8–25 × 2–4..........	Mostly 13–20 × 2·8–3·3.
3-septate............	23–48 × 3–4·5.......	Mostly 27–40 × 3·3–4.
5-septate............	30–50 × 3–5 (rare)....	Mostly 32–48 × 3·5–4.

Chlamydospores terminal and intercalary, 1-celled, 7–13 (av. 8·8), or 2-celled 12·6 × 7. The fungus has a strong, lilac-like odour on rice media.

Hab. *Hibiscus sabdariffa* L., from stems of wilting plant, Schagen, E. Transvaal (Wager).

This fungus is the cause of a vascular wilt of cotton, *Gossypium herbaceum* and *G. barbadense*, and probably also of *Hibiscus esculentus*. It occurs most frequently in North America. A vascular wilt of cotton caused by a *Fusarium* sp., has been observed in South Africa, and is probably due to this fungus, but it was not found during the time this work was in progress, and has not been studied in culture, nor have any tests of its pathogenicity been made.

FIG. 38.

Fusarium vasinfectum Atk.; conidia from (*a*) pionnotes of culture on plain agar, 7 days old; from sporodochia of 4 weeks old cultures on (*b*) oat agar, (*c*) standard synthetic agar plus starch, and (*d*) pionnotes of 8 weeks old culture on hard potato agar. (*e*) chlamydospores from mycelium on hard potato agar, culture 4 weeks old.

Growth on Standard Media.

Oat agar: Aerial mycelium rather sparse, fine, white, cottony. Growth on substratum vinaceous pink to light vinaceous purple; numerous minute sclerotia developed, especially near the base of the slant, up to 2 mm., diam., at first pale, becoming blue-black. Groups of sporodochia were light buff to light pinkish cinnamon. In some tubes there was a patch of dusky dull green plectenchyma at the base of the slant.

Hard potato agar: Mycelium short, white, sparse. Growth on substratum colourless. A few small sclerotia formed along the edge of the medium, especially where it was drying. Pionnotes developed along the needle track

Fusarium vasinfectum Atk. var. **lutulatum** (Sherb.) Wr.

Wollenweber, Fusarium-Monographie, 424, 1931; Fus. aut. del. 380, 1019, 1192. Wollenweber and Reinking, Die Fusarien, 125, 1935.

Syn. *Fusarium lutulatum* Sherb.

Fig. 40.

Fusarium vasinfectum Atk. v. *lutulatum* (Sherb.) Wr.; conidia from sporodochia and pionnotes of 2 weeks old cultures on (*a*) oat agar, (*b*) hard potato agar, (*c*) standard synthetic agar plus starch, (*d*) Melilotus stem; chlamydospores from (*e*) 4 weeks old culture on hard potato agar and (*f*) plain agar plates, 7 days old.

This variety has somewhat longer conidia than the type, and small, blue-black sclerotial bodies (up to 0·5 mm. diam.) may be numerous or absent. The conidia are mostly 3-septate, seldom 4- or 5-septate. Numerous 1–2-celled microconidia occur in the aerial mycelium.

3-septate..................................	Mostly 28–42 × 3·2–4·5.
5-septate..................................	Mostly 37–47 × 3·5–4·5.
6–7-septate..................................	Exceptional, 50–66 × 3·5–5.

Chlamydospores terminal and intercalary, 1-celled, 6–8 × 5–7; 2-celled, 8–12 × 4–7. The fungus is aromatic on rice media.

Hab. *Centaurea moschata* L., from stems of wilted plants, Pretoria (Wager) M.H. 28405.

Lathyrus odoratus L., from stems of seedlings which were wilting, and also from stems of plants dying when reaching the flowering stage (sometimes associated with *Pythium* sp.), Brooklyn, Pretoria (Doidge).

Pisum sativum L., from wilting seedlings and older plants, E. Transvaal (Wager).

Growth on Standard Media.

Oat agar : Aerial mycelium sparse, white, cottony. Growth on substratum pale vinaceous pink to pale flesh colour. A number of minute, scattered sclerotia, 0·1–0·5 mm. diam., which became deep delft blue, developed in some tubes. Numerous small sporodochia developed on the lower half of the slant: these were light vinaceous cinnamon to light ochraceous salmon, and they remained discrete, or coalesced to form a continuous pionnotal layer.

Hard potato agar : A little, short, white, cottony mycelium developed over the face of the slant. Small sporodochia and pionnotes formed freely; they were pale cinnamon pink to light vinaceous cinnamon.

Standard synthetic agar plus starch : Aerial mycelium scant. Growth on substratum colourless, or with a purplish tinge in places. Conidial masses vinaceous cinnamon to flesh colour, developing as on oat agar. Agar sometimes tinged pink. A few minute sclerotia occasionally developed.

Potato agar plus 5 per cent. dextrose : Aerial mycelium scant to moderate in amount, white to shell pink. Growth on substratum became wrinkled white to flesh colour, with patches of dark delft blue, which, after 14 days spread all over the slant, and in 8 weeks became almost black. The agar was stained dull Indian purple.

Potato plug : Plug covered with a mycelium which was cottony, white tinged lilac; or felt-like and wrinkled, pale salmon colour to seashell pink. The colour faded with age, and patches of deep delft blue appeared on the substratum; occasionally a few minute sclerotia developed. Sporodochia very numerous, pale salmon colour to light pinkish cinnamon, well developed after 4 weeks.

Melilotus stem : Stems covered with a short, white, felt-like mycelium. Sporodochia developed after 14 days; they were very numerous, scattered or in groups, minute, buff pink to light pinkish cinnamon.

Bean pod : Pods covered with a fair amount of white mycelium, which was cottony, or tomentose to sericeo-tomentose. Sporodochia developed in groups after 14 days, and were small, pale ochraceous buff.

Rice : Growth at first white to venetian pink and alizarine pink, or pale vinaceous later white to vinaceous and old rose. A few sclerotial bodies developed against the glass Cultures were aromatic, with an odour resembling lilac.

Measurements of Conidia.

Hard potato agar, culture 4 weeks old, conidia from pionnotes.

5-septate............	1 per cent..........	35–52·5 × 3·75–5.
4-septate............	3 ,, ...	35–52·5 × 4–4·5.
3-septate............	90 ,, ...	25–47·5 × 3·7–4·5.
1-septate............	1 ,,	
0-septate............	4 ,,	

Oat agar, culture 4 weeks old, conidia from sporodochia.

5-septate............	7 per cent..........	37·5–47·5 × 3·7–4·5.
4-septate............	15 ,, ...	35–42·5 × 3·7–4·5.
3-septate............	73 ,, ...	30–47·5 × 3·7–4·5.
0-septate............	5 ,,	

Melilotus stem, culture 4 weeks old, conidia from sporodochia.

4-septate............	0·5 per cent........	30–40 × 3·7–4·5.
3-septate............	92 ,, ...	20–45 × 3·5–4·5.
2-septate............	0·5 ,,	
1-septate............	1 ,,	
0-septate............	6 ,,	

Bean pod, culture 4 weeks old, conidia from sporodochia.

5-septate............	1	per cent........	40 42 × 4·5.
4-septate............	2·5	„	35-38 × 3·7–4·5.
3-septate............	73	„	22·5–40 × 3·2–4.
2-septate............	0·5	„	15–17·5 × 3·2–3·5.
1-septate............	3	„	15–17·5 × 2·7–3.
0-septate............	20	„	3·2–10 × 2·5 3.

Fusarium vasinfectum Atk. var. **zonatum** (Sherb.) **f. 1.** (Lk. et Bail.) Wr.

Wollenweber, Fusarium-Monographie 425, 1931; Fus. aut. del. 629, 1021. Wollenweber and Reinking, Die Fusarien, 126, 1935.

Syn. *Fusarium cepæ* Walker et Tims.

F. zonatum (Sherb.) *f.1* Lk. et Bail.

Fig. 41.

Fusarium vasinfectum Atk. v. zonatum (Sherb.) *f.*1 (Lk. et Bail) Wr. conidia from (*a*) sporodochia of · weeks old culture on Melilotus, and (*b*) thin pionnotes of 8 weeks old culture on oat agar, (*c*) chlamydospores from 12 weeks old culture on hard potato agar.

Differs from *F. vasinfectum* and its other varieties in the colour of the stroma and the conidial masses: growth on some media in concentric zones. Stroma pale, cream-coloured to salmon ochre, seldom purple red. Dark blue sclerotia and sclerotial stroma absent, but occasionally in cultures there occur erumpent, blister-like, raised, dark brown knots of plectenchyma from 0·5 mm. diam. Chlamydospores abundant; microconidia scattered in the aerial mycelium; macroconidia in salmon buff to ochraceous salmon pionnotes and sporodochia.

3-septate............	27·2-46·5 × 2·8-4·6	Average 37 × 3·8.
4-septate............	34·4-50 × 3·2 4·6...	Average 41·5 × 4.
5-septate............	37 50 × 3·3 4·6.....	Average 43·4 × 4.

The fungus is aromatic.

Hab. *Lycopersicum esculentum* Mill., from stems of wilting plants, Matatiele, E. Griqualand (Wager) M.H. 28387.

This fungus is known as a cause of bulb rot of onions, and also occurs on carrot, tomato and tulip in North America and Europe.

Growth on Standard Media.

Oat agar: Aerial mycelium sparse, white, cottony, mostly on the lower part of the slant. Growth on substratum colourless. Pionnotes developed more or less freely; they were salmon buff to ochraceous salmon.

Hard potato agar: Aerial mycelium sparse, short, white, rather coarse. Growth on substratum colourless. Pionnotes developed slowly.

Standard synthetic agar plus starch: No aerial mycelium. Growth on substratum colourless to pale ochraceous buff. Pionnotes developed slowly.

Potato agar plus 5 *per cent. dextrose* : Slant covered with a very small quantity of white, cottony mycelium. Growth on substratum tinged pale to light vinaceous purple, shading after 14 days to russet vinaceous. After 8 weeks, the agar was stained purplish brown.

Potato plug : Plugs covered with a moderate amount of aerial mycelium. No conidial masses developed in the cultures studied.

Melilotus stem : Stems covered with a short, white, felt-like mycelium. Sporodochia developed in groups after 4 weeks; they were salmon buff to light ochraceous salmon.

Bean pod : Pods covered with a short, white, felt-like mycelium, with patches of longer, cottony hyphae at the top. No conidial masses developed in the cultures studied.

Rice : Growth white to flesh pink or salmon buff. The culture was aromatic.

Measurements of Conidia.

Melilotus stem, culture 8 weeks old, conidia from sporodochia.

5-septate	0·5 per cent	33–45 × 3–4·5.
4-septate	2 ,,	23–45 × 3·5–4·5.
3-septate	96·5 ,,	22·5–49 × 3·3–4.
2-septate	0·5 ,,	
0-septate	0·5 ,,	

Oat agar, culture 4 weeks old, conidia from pionnotes.

5-septate	2·5 per cent	40–48 × 3·5–4·5.
4-septate	7 ,,	40–46 × 3·7–4.
3-septate	63 ,,	25–42·5 × 3–4·5.
2-septate	3·5 ,,	13–18 × 2·5–3·5.
1-septate	2 ,,	12–15 × 2·5–3.
0-septate	22 ,,	5–12 × 2–3.

Fusarium vasinfectum Atk. var. **zonatum** (Sherb.) **f. 2** (Lk. et Bail.) Wr.

Wollenweber, Fusarium-Monographie, 425, 1931 : Fus. aut. del. 1021. Wollenweber and Reinking, Die Fusarien, 126, 1935.

Syn. *Fusarium zonatum* (Sherb.) Wr. *f.* 2 Lk. et Bail.

Fig. 42.

Fusarium vasinfectum Atk. v. *zonatum* (Sherb.) *f.*2 (Lk. et Bail.) Wr. : conidia from sporodochia of 4 weeks old cultures on (*a*) oat agar, (*b*) standard synthetic agar plus starch, (*c*) potato plug and (*d*) Melilotus stem.

This fungus is only slightly aromatic, has no sclerotia, and differs from *f.* 1 in the red, almost purple, stroma, a lilac-tinted aerial mycelium and freely produced pionnotes. Conidia 3–6-septate, predominantly 3-septate; 3-sept. 38·5 × 3·7; 5-sept. 42·1 × 4·1. Chlamydospores abundant in mycelium and conidia.

Hab. *Allium cepa* L., from bulbs (scales showing light brown discolouration, moderately firm to soft), Nelspruit (Wager) and Pretoria (Wager) M.H. 28407 : from leaf bases of wilting plants, Nelspruit (Wager), and Eikenhof, near Johannesburg, October 1932.

This form occurs in North America, where it is a cause of bulb rot in onions. It also occurs on beet.

Growth on Standard Media.

Oat agar : Aerial mycelium short, sparse, white or tinged lilac. Growth on substratum deep vinaceous lavender to dull Indian purple. Numerous small sporodochia developed; they were light ochraceous salmon and 1–2 mm. in diameter.

Hard potato agar : Aerial mycelium sparse to moderate in amount, mostly short, longer at the top and bottom of the slant. Growth on substratum colourless. A thin pionnotes developed over the surface of the slant.

Standard synthetic agar plus starch : Aerial mycelium scanty. Growth on substratum tinged vinaceous lavender. A few, light ochraceous salmon sporodochia developed near the base of the slant.

Potato agar plus 5 per cent. dextrose : Aerial mycelium short, felt-like, white to lavender. Growth on substratum vinaceous lavender to dull Indian purple. After some time the growth became wrinkled.

Potato plug : Cylinder covered with a fairly copious growth of white, cottony mycelium, which tended to become wrinkled and felt-like on the face of the plug. Very numerous, small, ochraceous salmon sporodochia developed. In many cases, these seemed to arise from small, brown to blackish masses of plectenchyma.

Melilotus stem : Mycelium scant, white to dirty white, very short and felt-like, or sericeo-tomentose in coarse tangled strands. Numerous small sporodochia developed, and also pionnotes; these were pinkish cinnamon to ochraceous salmon.

Bean pod : Aerial mycelium moderate in amount, coarse, white, tomentose. Numerous small sporodochia developed; they were scattered or in groups, and pinkish cinnamon to ochraceous salmon in colour.

Rice : Aerial mycelium at first white to vinaceous lilac, becoming rhodomite pink. Growth on grains was vinaceous lilac to deep purplish vinaceous, becoming neutral red, and finally alizarine pink to acajou red. Numerous small plectenchymatous masses formed against the glass; they became brownish, then sepia to almost black. The culture was slightly aromatic.

Measurements of Conidia.

Oat agar, culture 4 weeks old, conidia from sporodochia.

5-septate	5 per cent.	42·5–52·5 × 3·7–4.
4-septate	22 ,,	35–52·5 × 3·25–4.
3-septate	70 ,,	27·5–52·5 × 3·25–4. mostly 35–40 long.
0-septate	3 ,,	

Potato plug, culture 4 weeks old, conidia from sporodochia.

5-septate	1 per cent.	37·5–45 × 3·75–4.
4-septate	5 ,,	30–40 × 3–4.
3-septate	72 ,,	30–42·5 × 3–4.
1-septate	1 ,,	8–17·5 × 2–3·5.
0-septate	21 ,,	5–10 × 2–3·25.

Melilotus stem, culture 8 weeks old, conidia from sporodochia.

5-septate	1·5 per cent.	37·5–45 × 4–4·5.
4-septate	5 ,,	35–45 × 3·5–4·5.
3-septate	91·5 ,,	25–42·5 × 3·5–4.
0-septate	2 ,,	

Chlamydospores formed in many of the conidia.

Fusarium redolens f.l. Wr.

Wollenweber, Fusarium-Monographie, 426, 1931; Fus. aut. del. 1022. Wollenweber and Reinking, Die Fusarien, 127, 1935.

Microconidia 1-celled, 9 × 3, or 1-septate, 16 × 4·5. Macroconidia 3-septate, less frequently 4-septate, exceptionally 5-septate, fusiform-falcate, curved, sometimes recalling

those of *F. solani*, but, in the more compact conidial forms, somewhat thicker in the upper third than in the middle; gradually tapering towards the base, which is pedicellate or papillate. Conidia in sporodochia or pionnotes, brownish-white, cream-colour, or light flesh colour in mass.

3-septate............	17-51 × 3-6·5.......	Mostly 29-43 × 3·7-5·5.
5-septate............	31-61 × 3·5-6·5.....	Mostly 37-47 × 4-6.

Chlamydospores terminal and intercalary, 1-celled 3-12, (mostly 6-9) 2-celled 11-21 × 5-14, (average 14 × 8·2), smooth or rough, in conidia or mycelium. Blue sclerotia wanting. Plectenchymatous stroma effuse, pale, pinkish white or lilac colour. The fungus is not aromatic.

Hab. *Lycopersicum esculentum* Mill., from seed offered for sale (Wager).

FIG. 43.

Fusarium redolens f.1 Wr.; conidia from (*a*) sporodochia of 2 weeks old culture on Melilotus stem, and (*b*) pionnotes of 6 days old plate culture on plain agar, (c) microconidia and chlamydospores from plain agar plates, 6 days old.

Growth on Standard Media.

Oat agar: Aerial mycelium sparse, white to shell pink. Growth on substratum buff pink to onion skin pink. Pionnotes well developed, pale pinkish cinnamon or pinkish cinnomon to orange cinnamon.

Hard potato agar: Aerial mycelium scanty to none. Growth on substratum colourless. A few small sporodochia formed near the base of the slant.

Standard synthetic agar plus starch: No aerial mycelium. Growth on substratum colourless or tinged cinnamon. Sporodochia at first tilleul buff, becoming pale ochraceous buff when well developed.

Potato agar plus 5 per cent. dextrose: Aerial mycelium scant, white, in patches. Growth on substratum colourless. Pionnotes pale cinnamon pink.

Potato plug: Plug covered with a matted mycelium, which was tilleul buff to pale vinaceous fawn, and became wrinkled when cultures were 3 weeks old. Conidial masses developed between the medium and the glass.

Melilotus stem: Aerial mycelium scanty, white. Sporodochia tilleul buff to light pinkish cinnamon, not very large, and scattered or in groups.

Bean pod: Pod covered with a copious aerial mycelium, which was white to pallid vinaceous drab to pale vinaceous fawn. Growth became wrinkled and felt-like.

Rice: Growth white to pale flesh colour. Small, white plectenchymatous bodies formed between the medium and the glass. The culture was not aromatic.

Measurements of Conidia.

Oat agar, culture 19 days old, conidia from pionnotes.

3-septate............	42 per cent..........	29–45 × 6–6·25.
2-septate............	9 ,, ...	28–32·5 × 3·75–5.
1-septate............	17 ,, ...	22·5–29 × 3·7–6;25.
0-septate............	32 ,, ...	4·5–10·5 × 3·7–4·5.

Melilotus stem, culture 15 days old, conidia from sporodochia.

4-septate............	2 per cent........	40–44 × 5–6·25.
3-septate............	96·5 ,, ...	25–42·5 × 3·75–6.
2-septate............	0·5 ,, ...	21–22 × 4–5.
1-septate............	0·5 ,, ...	15–20 × 3·7–5.
0-septate............	0·5 ,, ...	7·5 × 3·75.

Standard synthetic agar plus starch, culture 8 weeks old, conidia from sporodochia.

4-septate............	0·5 per cent........	40–45 × 4–5·5.
3-septate............	99 ,, ...	28–38 × 4·8–6·3.
2-septate............	0·5 ,, ...	30–31 × 4·8–5.

The shorter conidia often stouter than the longer ones.

Plain agar plate, culture 6 days old.

5-septate................................	45–55 × 4–6.
4-septate................................	42·5–52·5 × 4–5·5.
3-septate................................	42·5–47·5 × 4–5.

Section MARTIELLA.

Wollenweber, Phytopathology, 3: 30, 1913. Wollenweber and Reinking, Die Fusarien, 127, 1935.

Fungi of this group are chiefly found in the soil and in subterranean parts of plants. Macroconidia dorsiventral, fusiform to falcate, thick-walled, curvature slight in the central part of the conidium, more decided near the apex; apex rounded or tapering; base subpedicellate or mammillate. The medial diameter of the macroconidia is of diagnostic value in this section. Microconidia mostly 1-celled, small, oval to oblong. Conidial masses pale, white, yellowish or brownish, or in older cultures darker, honey colour to amber, or becoming tinged with the colour of the stroma. Stroma yellow brown to dark blue, the brightest colours occurring on carbohydrate media. Sclerotial bodies erumpent on certain substrata, brown, green, violet or blue black. Chlamydospores usually produced freely, terminal or intercalary, developing in chains or clusters, smooth or rough.

It has been established that members of the genus *Hypomyces* represent the ascus stage of a few of the Martiella-Fusaria.

Key to the South African Species.

A.—Dorsiventrality of conidia distinct only at the apical end.

a.—Conidia almost cylindrical to fusiform-falcate, obliquely conical or rounded at the apex; obtuse, mammillate or with an oblique papilla at the base.

b.—Conidia 3- (0–5) septate; 3-sept. 34 × 4·8; 5-sept. 42 × 5·2 .... *F. coeruleum.*

AA.—Dorsiventrality of fusiform-falcate conidia distinct at both ends. Base mammillate to sub-pedicellate.

a.—Medial diameter of 3–5-sept. conidia 4–5:

b.—Conidia in masses mostly 3-septate .... *F. javanicum* v. *radicicola.*

bb. Conidia in masses mostly 3–5-septate .... *F. javanicum.*

aa.—Medial diam. of 3–5-sept. conidia 5–6:

b.—Conidia in masses mostly 3-septate:

c.—Conidia 3-sept. 36 × 5·5; 5-sept. 49 × 5·3 *F. solani.*

cc.—Conidia 3-sept. 39 × 5; 5-sept. 49 × 5·3 *F. solani* v. *Martii f.* 1.

Fusarium javanicum Koord.

Koord, Verh. Koninkl. Akad. Wetensch. Amsterdam, 11, 13: 247, 1907. Wollenweber, Fus. aut. del. 424, 426–428, 1025–1027. Wollenweber and Reinking, Die Fusarien, 131, 1935.

Syn. *Fusarium theobromae* App. et Strk. **F. javanicum** Koord. v. theobromae (App. et. shk.) Wr.

Fusarium heveae P. Henn. in herb. (non Vincens).

Fusoma glandarium Corda.

Conidia in mass brownish white to light brown; when older, coffee brown, or tinged with the colour of the stroma. Stroma leathery to gelatinous, seldom sclerotial, usually olive green to olive brown. Microconidia 1-celled or septate, usually scattered freely in the aerial mycelium. Macroconidia in sporodochia and pionnotes, falcate, slightly curved often rather more decidedly curved at the apex, constricted at both ends, more or less pedicellate at the base, 3–5-septate, exceptionally 6–8-septate.

0-septate	8 × 3.	
1-septate	18 × 3·6.	
3-septate	22–54 × 3·5–6	Mostly 28–47 × 4–5.
5-septate	35–60 × 4–6	Mostly 40–56 × 4·5–5·3.
7-septate	60 × 5.	

Chlamydospores 1–2-celled, 5–8 μ diameter.

Hab. *Cucurbita Pepo* L., and *C. maxima* Duchesne; from stems of wilting plants of pumpkin, marrow and Hubbard squash, Hennops River and Daspoort, Pretoria Dist. (Kresfelder) M.H. 28414; Uitenhage, Cape, Nov. 1935 (Haines.)

This fungus causes extensive damage in commercial plantings of pumpkin, marrow and squash. In other warm countries, *F. javanicum* is known as a rot-producing organism in coffee, cocoa, rubber, etc. It also occurs in the temperate zone on poplar and elm.

Growth on Standard Media.

Oat agar: Aerial mycelium scant to none. Very numerous, minute sporodochia developed, which coalesced more or less completely to form a continuous pionnotes; the conidial masses were cream buff, and developed in irregular patches. Growth on substratum colourless to wood brown.

Hard potato agar: Mycelium not abundant, rather coarse, short, white to ivory yellow. Sporodochia numerous, minute, crowded, coalescing to form pionnotes, cream buff to chamois, often developing in concentric zones round the point of transfer. Pionnotes on this, and on other media, rather dry, and inclined to crumble when touched with a needle; less frequently of the consistency of cream cheese.

Standard synthetic agar plus starch: Aerial mycelium scant to none. Conidial masses developed freely all over the surface of the slant, often in concentric zones round the point of transfer, cream buff to light pinkish cinnamon. Growth on substratum colourless, except at the base of the slant, where it was wood brown.

Potato agar plus 5 per cent. dextrose: Growth dense, felt-like, zoned, wood brown, avellaneous and cartridge buff, or citrine drab and yellowish olive. Pionnotes developed freely; they were wood brown or tinged lincoln green.

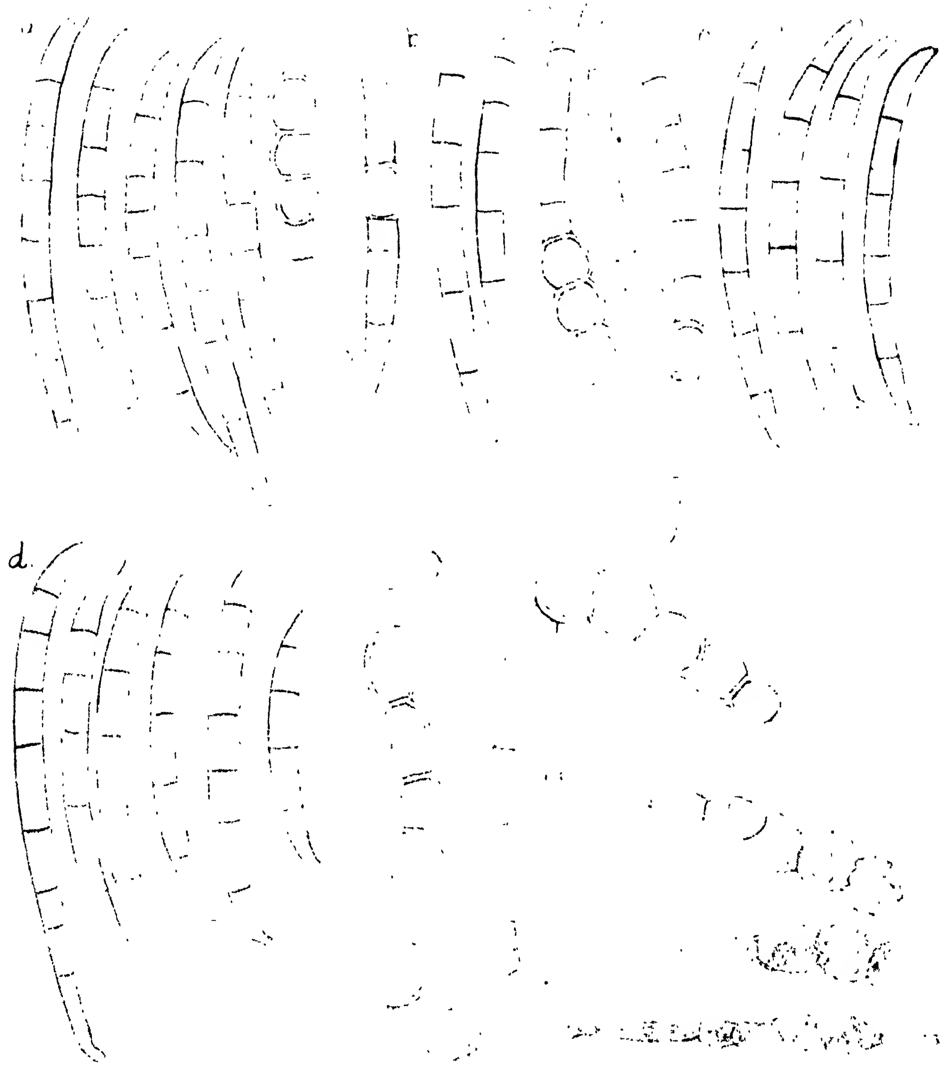

FIG. 44.

Fusarium javanicum Koord.: conidia from (*a*) mycelium of 19 days old culture on plain agar, (*b*) pionnotes of 4 weeks old culture on hard potato agar, (*c*) pionnotes of 5 weeks old culture on oat agar, (*d*) sporodochia of 2 weeks old culture on bean pod, (*e*) chalmydospores from 4 weeks old culture on oat agar, and (*f*) from culture 8 weeks old on Melilotus stem.

Potato plug: Aerial mycelium very sparse, white, cottony; sometimes a few white tufts of mycelium appeared near the top of the plug. The rest of the cylinder became covered with conidial masses; these consisted of very numerous, minute, crowded sporodochia, which coalesced to form a dense pionnotes. Conidial masses at first cartridge buff, becoming pinkish buff to sage green, and in places dark bluish glaucous to Russian green.

Melilotus stem: Mycelium sparse, white to cartridge buff. Conidial masses developed freely; they were chamois to cinnamon buff. Numerous minute, black sclerotia formed under the mycelium.

Bean pod : Mycelium white, felt-like, wrinkled. Conidial masses formed a thick crust, which was at first chamois, and later chamois to cinnamon buff.

Rice : Aerial mycelium tilleul buff. Growth on grains vinaceous buff to avellaneous. Grains were army brown to Natal brown.

Measurements of Conidia.

Hard potato agar, culture 2 weeks old, conidia from pionnotes.

6-septate	2 per cent	67·5–80 × 5.
5-septate	45 ,,	57·5–75 × 4·5–5·5.
4-septate	8 ,,	47·5–67·5 × 4·5–5.
3-septate	12 ,,	25–50 × 3·7–4·5.
2-septate	0·5 ,,	20–27·5 × 3·7–5.
1-septate	17 ,,	12·5–17·5 × 3·5–5.
0-septate	15·5 ,,	10·5–12·5 × 3·5–4.

Oat agar, culture 5 weeks old, conidia from pionnotes.

5-septate	28 per cent	60–75 × 4·7–5.
4-septate	59 ,,	55–69 × 3·7–5.
3-septate	3 ,,	45–62·5 × 3·7–4·7.
2-septate	1·5 ,,	
1-septate	4·5 ,,	
0-septate	4 ,,	

Potato plug, culture 4 weeks old, conidia from pionnotes.

5-septate	12·5 per cent	47·5–62·5 × 4–4·5.
4-septate	56 ,,	45–52·5 × 4–4·5.
3-septate	19 ,,	30–52·5 × 3·7–4·5.
2-septate	1·5 ,,	27·5–45 × 4–4·5.
1-septate	6·5 ,,	17·5–22·5 × 3–4.
0-septate	4·5 ,,	7·5–15 × 3·7–4.

Melilotus stem, culture 4 weeks old, conidia from pionnotes.

5-septate	2·5 per cent	55–57·5 × 4–5.
4-septate	30 ,,	45–52·5 × 4–5.
3-septate	13·5 ,,	42·5–47·5 × 3·7–4·5.
2-septate	2·5 ,,	20–32·5 × 3–3·75.
1-septate	19 ,,	12·5–21 × 3–4·5.
0-septate	32·5 ,,	6·25–12·5 × 3–4.

Standard synthetic agar plus starch, culture 4 weeks old, conidia from pionnotes.

5-septate	7 per cent	42·5–67·5 × 5.
4-septate	43 ,,	37·5–70 × 3·7–5.
3-septate	25 ,,	35–65 × 3·7–5.
2-septate	1 ,,	33·75 × 4·4.
1-septate	11 ,,	
0-septate	13 ,,	

Chlamydospores common in mycelium and conidia. In oat agar plates 4 weeks old, they were commonly in simple or irregular chains of 2 to 9 elements; these were mostly terminal. Intercalary chlamydospores were often solitary. Single spores 7·5–12·5 μ diameter. They were sometimes in loose groups, but were never seen in closely united packets as in *F. solani.* In hard potato agar plates, 4 weeks old, chlamydospores were forming in a large proportion of the conidia. These were terminal (often in the basal cell or cells) or intercalary; they were single, in pairs, or rarely in chains of 3 to 4 elements; thick walled, rough when mature, 5·6–11·25 diam.

Fusarium javanicum Koord. var. **radicicola** Wr.

Wollenweber, Fusarium-Monographie, 286, 1931; Fus. aut. del. 423, 632, 1023, 1024. Wollenweber and Reinking, Die Fusarien, 129–130, 1935.

Syn. *Fusarium radicicola* Wr.

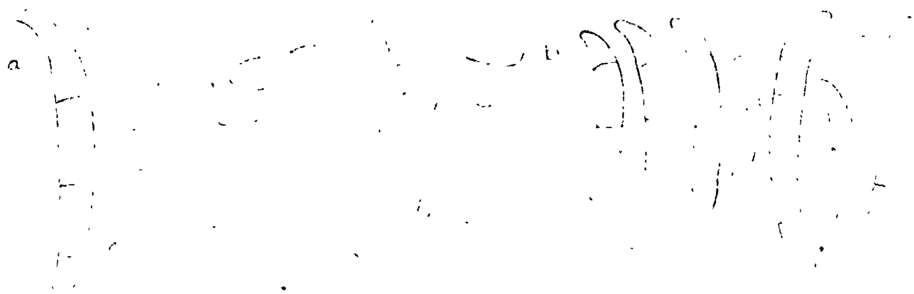

Fig. 45.

Fusarium javanicum Koord. v. *radiciola* Wr.: conidia from pionnotes of culture on (*a*) potato plug, (*b*) bean pod; both cultures 4 weeks old.

Microconidia numerous, 1-celled or septate, scattered in the mycelium, or cohering in false heads. Macroconidia in sporodochia, or less frequently in pionnotes, brownish white in mass, becoming darker with age, or taking up colour from the olive green or coffee brown stroma. Macroconidia 3-septate, less frequently 4-, and exceptionally 5-septate, elongated, slightly curved, somewhat more definitely curved, and constricted at the apex, sub-pedicellate at the base.

0-septate............	4–15 × 1·7–4·5......	Mostly 6·3–10 × 2–3.
1-septate............	8–27 × 3–5..........	Mostly 13–17 × 3·7–4·3.
3-septate............	20–50 × 3·4–5·3.....	Mostly 30–42 × 3·8–4·8.
5-septate............	38–59 × 4–5·3.......	Mostly 43–46 × 4–5·1.

Chlamydospores common, terminal and intercalary, 1–2-celled, in chains or clusters; 1-celled 9–10 × 8·5–9; 2-celled 16–22 × 5–12; smooth or rough.

Hab. *Pelargonium* sp., from discoloured rhizome, Pretoria (Wager).

Solanum tuberosum L., from tubers showing a black form of dry rot, Umhlanga Beach, near Mt. Edgecombe, Natal, Jan. 1931 (van der Plank).

This fungus is known in the United States as a cause of potato rot; it is also found in other root crops, and in ornamental plants.

Growth on Standard Media.

Oat agar: Aerial mycelium short, sparse, white, tomentose. Growth on substratum colourless. Conidial masses did not develope freely on this medium. Reinking and Wollenweber (39) record the development on oat agar of "olive buff and pea green sporodochia in large heaps, gradually forming a pionnotes."

Hard potato agar: Mycelium not abundant, rather coarse, tomentose, short. Sporodochia, when present, in groups, cream buff to olive buff and lichen green; often forming in concentric rings. In some old cultures, the agar was stained Natal brown.

Standard synthetic agar plus starch: Slant covered with short, white mycelium, which was mealy-looking owing to the presence of numerous conidia. Growth on substratum colourless to wood brown.

Potato agar plus 5 per cent. dextrose: Aerial mycelium scant, short, mealy-looking. Growth on substratum buff pink to vandyke brown; agar stained Japan rose.

Potato plug : Aerial mycelium rather coarse, short, tomentose or felt-like, white to cream buff and buff pink, or, when older, tilleul buff to buff pink and vinaceous brown ; brown in places after 12 weeks. Sporodochia in groups, at first vinaceous buff, then olive buff and light terre verte.

Melilotus stem : Stems covered with a rather short, white, coarse, tomentose mycelium. Sporodochia and pionnotes developed in longitudinal lines ; they were pinkish buff to dark olive buff.

Bean pod : Pods covered with a rather sparse, coarse mycelium, which was white to pale cinnamon pink. Pinkish buff sporodochia and pionnotes developed in patches.

Rice : Aerial mycelium short, white, mealy ; growth on substratum purplish vinaceous to dark livid brown and wood brown.

Measurements of Conidia.

Melilotus stem, culture 4 weeks old, conidia from sporodochia.		
5-septate	6 per cent	40–59 × 4·5–5·5.
4-septate	16 ,,	35–48 × 3·7–5.
3-septate	26 ,,	22·5–42 × 3·7–5.
2-septate	4 ,,	20–27·5 × 3·7–4.
1-septate	9 ,,	15–20 × 3·2–4.
0-septate	39 ,,	5–12·5 × 3–3·75.
Potato plug, culture 4 weeks old, conidia from mycelium.		
5-septate	16·5 per cent	35–52·5 × 4·5–5·5.
4-septate	7·5 ,,	32·5–40 × 4·5–4·3.
3-septate	8 ,,	20–32·5 × 4–5.
2-septate	0·5 ,,	16–18 × 3·7–5.
1-septate	1·5 ,,	12·5–17·5 × 3–5.
0-septate	66 ,,	3·75–10 × 3·2–5·5.
Bean pod, culture 2 weeks old, conidia from pionnotes.		
5-septate	Rare	40–57·5 × 5.
4-septate	0·5 per cent	39–52·5 × 5.
3-septate	27 ,,	22·5–45 × 3·7–5.
2-septate	16 ,,	
1-septate	14 ,,	
0-septate	42·5 ,,	

Non-septate conidia oval, pyriform or spherical; 1-septate usually comparatively slender, but occasionally resembling the 1-celled conidia in form.

Fusarium solani (Mart.) App. et Wr.

Appel and Wollenweber, Arb. K. Biol. Anst. Land.- u. Forstw. 8 : 65–78, 1910. Wollenweber, Fus. aut. del. 396–400, 404, 405, 418–421, 1029, 1031–1033, 1194. Wollenweber and Reinking, Die Fusarien, 135, 1935.

Syn. ***Fusisporum solani*** Martius pro parte.

Fusisporum solani Mart. v. *flavum* Hart.

Fusisporum solani-tuberosi Desm. ; *Pionnotes solani-tuberosi* (Desm.) Sacc.

Fusarium commutatum Sacc.

Lachnidium acridiorum (Trab.) Giard. ; ***Fusarium acridiorum*** (Trab.) Brougn. et Del.

Fusarium allii-sativi All. ; ***F. alluviale*** Wr. et Rkg. ; ***F. Malli*** Taub.

F. solani (Mart.) v. *cyanum* Sherb. ; ***F. solani*** (Mart.) *f.* 1 Wr.

F. solani (Mart.) v. ***medium*** Wr. ; ***F. solani*** (Mart.) v. ***suffuscum*** Sherb.

F. viride (Lechm.) Wr. ; ***Pionnotes viridis*** Lechm.

Conidia scattered, in false heads, in sporodochia or in pionnotes, in mass brownish white to clay yellow, or tinged with blue, or flecked with green from the stroma. Stroma leathery, or sclerotial, green to dark blue. Macroconidia almost cylindrical-fusiform,

slightly curved, rounded at both ends, or tapering and bluntly conical; base with a scarcely-perceptible papilla, which is oblique to the longitudinal axis, seldom sub-pedicellate, 3 or 3-5-septate.

0-septate............	11 × 3·8.	
1-septate............	20 × 4·3.	
3-septate............	19–50 × 3·5–7.......	Mostly 28–42 × 4·1–6·2.
4-septate............	42 × 5·6.	
5-septate............	32–68 × 4 7.........	Mostly 42 51 × 5–6·3.

Chlamydospores terminal and intercalary, brownish, single, spherical to pear-shaped; 1-celled 8·5 × 8; 2-celled 9 16 × 6–10; seldom in chains and clusters, smooth, or sometimes minutely verrucose, and rough when dry.

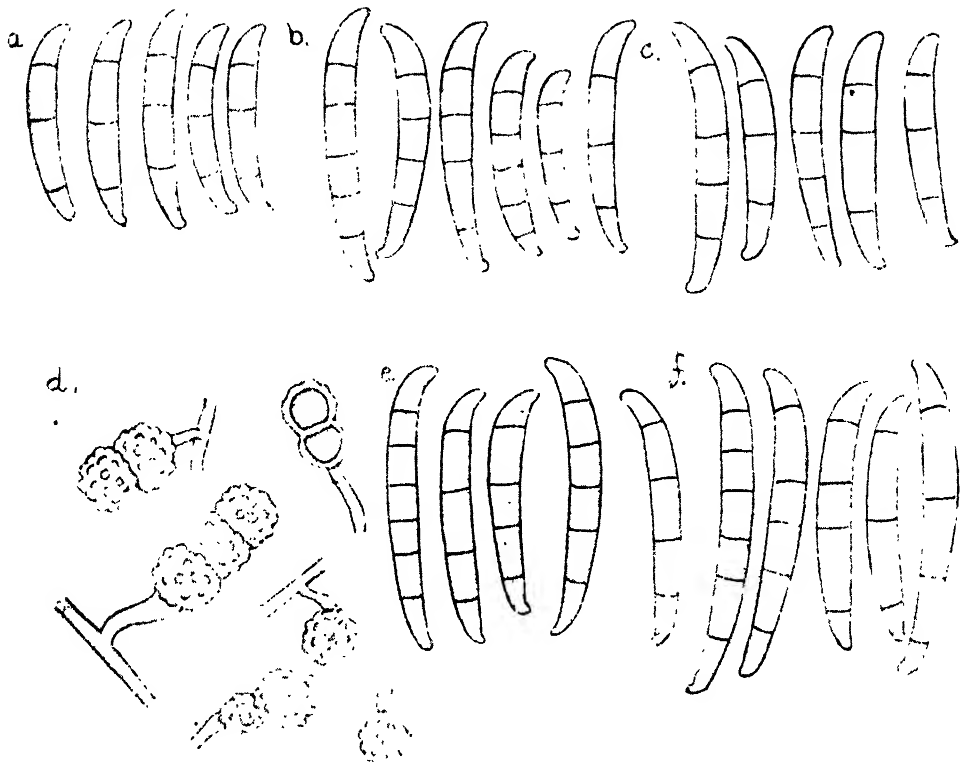

FIG. 46.

Fusarium solani (Mart. pr. p.) App. et Wr.; (*a-d*) strain from wheat, (*e-f*) from collar rot of orange tree; conidia from (*a*) sporodochia of 4 weeks old culture on Melilotus stem (band e) pionnotes of 3 weeks old cultures on hard potato agar, (*c* and *f*) pionnotes of 5 weeks old cultures on oat agar, (*d*) chlamydospores from 8 weeks old culture on hard potato agar.

Hab. *Allium cepa* L., from discoloured bulbs, and stems of dying plants, Nelspruit (Wager) M.H. 28383. Also recorded by du Plessis (11) as causing a dry rot of onions in storage, Stellenbosch, Cape.

Carica papaya L., from stem of plant affected by foot rot, Maritzburg, Natal (Wager); Malelane, E. Transvaal (Wager) M.H. 28375 and 28374.

Citrus grandis Osbeck, from bark of grapefruit tree showing gummosis, Patentie, Cape (van der Plank) M.H. 28401; Coegapoort, Gamtoos Valley, Cape (van der Plank) 1930 (from collar of 2-year old tree).

Citrus limonia Osbeck, from roots of lemon stocks on which orange or grapefruit had been budded, roots showing "dry root rot" lesions; Louis Trichardt, N. Transvaal; Bathurst dist., Cape (van der Plank); Thorndale, Hankey, Cape (van der Plank) M.H. 28371; Acornhoek, E. Transvaal, M.H. 28396; Tzaneen, N. Transvaal (Wager); Elandshoek, E. Transvaal, M.H. 28372; Coegapoort, Gamtoos Valley, Cape, 1930 (van der Plank). Also from soil in Citrus orchard Kosterfontein, Marico dist., Transvaal (Esselen).

Citrus sinensis Osbeck, from bark above union, which was cracking and gumming (roots waterlogged) Letaba Estates, N. Transvaal; from bark of tree affected with scaly bark (psorosis) Mazoe Estates, S. Rhodesia (Bates); from roots of old seedling orange, Viliersdorp, Cape, M.H. 28360.

Dianthus caryophyllus L., from stem of plant affected with crown rot (ass. *F. bulbigenum* v. *lycopersici*) Pretoria.

Gilia rubra Heller, from stems of wilting plants. Acton Homes, Natal

Gladiolus sp., from corms showing a dry brown rot (ass. *F. oxysporum* v. *gladioli*) Princess Park. Pretoria.

Phaseolus sp., from stems of dying plant, Swaziland (Wager).

Solanum tuberosum L., from tubers showing dry rot and soft rot in a consignment imported from Germany. Also isolated by du Plessis (13) from rotting tubers, Ceres, George, Paarl and Stellenbosch, Cape.

Tropaeolum majus L., from stem of dying plant, Pretoria.

Zea mays L., from base of stem of plant showing foot rot (ass. *F. moniliforme*) Waterberg, Transvaal (Sellschop).

Fusarium solani is a rotting organism and is seldom a primary cause of injury. It occurrs on a wide range of plants, chiefly in the temperate zone.

Growth on Standard Media.

Oat agar: Aerial mycelium sparse, rather coarse, tomentose. white or dirty white. Conidial masses developed freely; pionnotes and sporodochia at first cartridge buff, becoming pinkish buff, and in older cultures stained bluish grey green to dark russian green. Sporodochia were produced in large groups.

Hard potato agar: Some rather coarse, scant, white, tomentose mycelium developed over the face of the slant, sometimes becoming mealy owing to the formation of conidia, and sometimes showing concentric zoning. Pionnotes developed freely and groups of sporodochia near the base of the slant; spore masses were at first cartridge buff, becoming pinkish buff and dark bluish glaucous.

Standard synthetic agar plus starch: Aerial mycelium short, scant white. Pionnotes developed freely, especially along the needle track; they were cartridge buff. A few, small, blackish-brown sclerotia appeared near the base of the slant.

Potato agar plus 5 per cent. dextrose: Mycelium moderate in amount, at first white to cartridge buff. Growth on substratum cream to sage green, becoming dark olive to clove brown. In older cultures the mycelium became tinged with the colour of the stroma. A number of blackish-brown sclerotia developed at the base of the slant.

Potato plug: Plug covered with a moderate amount of rather coarse mycelium, wnich was white to dirty white; there were a few patches and flecks of dark terre verte at the base and back of the plug. Large groups of sporodochia were usually produced, and coalesced to form a pionnotal mass; spore masses were at first cartridge buff to pinkish buff, and later tinged bluish grey green to glaucous or deep lichen green. In some tubes a few small, dark brown sclerotial masses developed.

Melilotus stem: Mycelium sparse, loose, coarse, white to dirty white. Pionnotes and groups of sporodochia were pinkish buff to deep bluish glacious. A few dark brown sclerotial masses were present.

Bean pod : Mycelium rather plentiful, or sparse, coarse, tomentose or becoming wrinkled and felt-like, white to cartridge buff. Large sporodochia developed in groups ; they were cartridge or pinkish buff to deep bluish grey green.

Rice : Growth white to light purple drab ; grains white to naples yellow.

Measurements of Conidia.

Oat agar, culture 4 weeks old, conidia from pionnotes.		
5-septate............	1 per cent........	38–50 × 5–5·5.
4-septate............	25 ,, ...	37·5–50 × 5–6·25.
3-septate............	73·5 ,, ...	30–42 × 5–5·5.
1-septate............	0·5 ,,	
Bean pod, culture 4 weeks old, conidia from sporodochia.		
5-septate............	2 per cent..........	37·5–50 × 5–5·6.
4-septate............	43 ,, ...	32·5–45 × 5.
3-septate............	51 ,, ...	27·5–50 × 5–5·5, mostly 30–40 × 5.
0-septate............	4 ,,	
Hard potato agar, culture 3 weeks old, conidia from pionnotes.		
5-septate............	1·5 per cent........	36·2–45 × 5.
4-septate............	16 ,, ...	25–42·5 × 5.
3-septate............	81 ,, ...	27·5–42·5 × 4·7–5.
1-septate............	1·5 ,,	
Oat agar, culture 2 weeks old, conidia from sporodochia.		
5-septate............	Rare................	47·5 × 5.
4-septate............	6 per cent.	35–45 × 4–5
3-septate............	79 ,, ...	35–40 × 4–5.
2-septate............	9 ,, ...	22·5–30 × 3·7–4.
1-septate............	2·5 ,, ...	15–20 × 3·7–4.
0-septate............	3·5 ,, ...	7·5–15 × 2·5–3·75.

Fusarium solani (Mart.) v. **Martii** (App. et Wr.) **f. 1.** Wr.

Wollenweber, Fusarium-Monographie, 290, 1931; Fus. aut. del. 415–417, 631. Wollenweber and Reinking, Die Fusarien, 137, 1935.

Syn. *Fusarium Martii* App. et Wr. v. *minus* Sherb.

Fusarium Martii App. et Wr. v. *viride* Sherb.

? *Fusarium pestis* Sor.

Conidia more slender than those of *Fusarium solani*, with hardly any curvature in the medial portion, more definitely curved or bent near the apex, base papillate or sometimes pedicellate. Macroconidia 3-septate, more rarely 4-septate, exceptionally 5-septate ; microconidia 0–2-septate.

0-septate............	8 × 3·8.	
1-septate............	17 × 4·5.	
3-septate............	22–52 × 3·5–6.......	Mostly 30–44 × 4·5–5·5.
4-septate............	46 × 5·2.	
5-septate............	39–62 × 4·2–6.......	Mostly 43–57 × 4·3–5·5.

Conidia in mass brownish-white, or ivory yellow to light brown ; often absorbing colour from the greenish blue or brown stroma, and then with a mixture of wood brown, grey and coffee brown to blackish tones. Chlamydospores in conidia 8·5 × 6; in mycelium 1-celled, 10 × 8, 2-celled 8–22 × 6–12.

Hab. *Allium cepa* L., from rotting bulb, Pretoria, 1932 (Bottomley).

Carica papaya L., from stems of plants showing foot rot, Maritzburg, Natal (Wager) ; Buffelspoort, Marikana, W. Transvaal (Wager) M.H. 28373 ; Nelspruit, E. Transvaal (Wager).

Centaurea moschata L., from stems of wilted plants, Pretoria (Wager).

Citrus grandis Osbeck, from bark of tree showing gummosis, Patentie, Cape (van der Plank).

Citrus limonia Osbeck, from roots of lemon stocks on which orange grapefruit or naartje had been budded, roots showing "dry root rot" lesions; Grahamstown, Cape (van der Plank) M.H. 28376; Godwan River, E. Transvaal, Oct. 1930 (Marloth); Swanepoelsrust, near Nylstroom, M.H. 28366; Plaston, E. Transvaal (Esselen); White River, E. Transvaal; Buffelspoort, Marikana (Turner); Elizabethville, Belgian Congo, M.H. 28367; Avonmore, Rustenburg dist., and Kosterfontein, Marico dist., W. Transvaal (Esselen); Addo, Cape, M.H. 28368; Magaliesburg, Transvaal, Nov. 1929 (van der Plank); Citrusdal, Cape (Turner) M.H. 28369; Airlie, E. Transvaal (van der Plank); White River (Esselen) M.H. 28370; Kakamas, Cape (Gutsche): Hankey, Cape (van der Plank); Kruis River, Cape, May 1930 (van der Plank) M.H. 28397; Louisvale, Cape (Turner) M.H. 28399; Amanzi, Cape, May 1930 (van der Plank) M.H. 28399; Ofcalaco, N. Transvaal July 1930 (van der Plank); Gamtoos Valley, Cape, Aug. 1930 (van der Plank); Elandshoek, E. Transvaal, July 1930.
Also from roots not visibly affected by root rot, and from the soil, Boskopjes, Rustenburg dist.

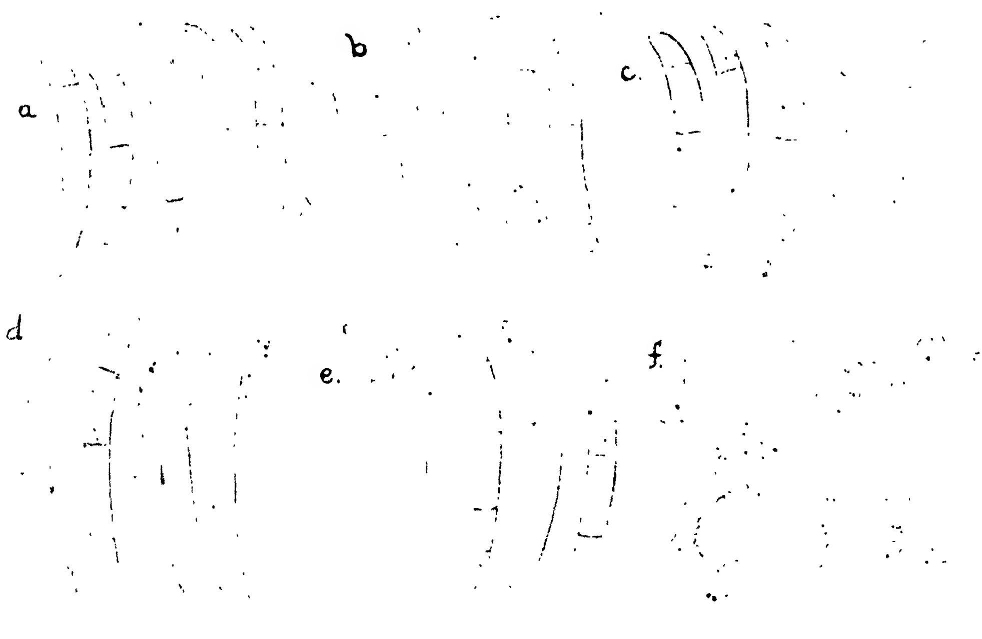

Fig. 47.

Fusarium solani (Mart. pr. p.) App. et. Wr. v. *Martii* (App. et. Wr.) *f*.1 Wr.; conidia from (*a*) sporodochia of 5 weeks old culture on Melilotus stem, (*b*) sporodochia of 10 weeks old culture on potato plug, (*c*) pionnotes of 3 weeks old culture on hard potato agar, (*d*) pionnotes of 4 weeks old culture on oat agar, (*e*) pionnotes of 4 weeks old culture on hard potato agar, (*f*) chlamydospores from 4 weeks old culture on hard potato agar.

Citrus sinensis Osbeck, from bark cracking above union (roots waterlogged) Letaba Estates, N. Transvaal; from bark and wood, Boschrand, E. Transvaal and Elandsdrift, Rustenburg dist. (Turner); from crown, bark and roots of seedling orange, near Klaver,

van Rhynsdorp dist., Cape (Putterill); from roots of old seedling orange with dry root rot lesions, Villiersdorp, Cape, M.H. 28358 and 28361; from bark of navel orange showing gummosis, Frantzina's Rust, E. Transvaal, August 1930 (van der Plank).

On fruit, after 12 to 18 weeks in storage, mostly from stem end occasionally from navel end and lateral lesions; on navel oranges from Sunday's River, Cape, and from White River, Rustenburg and Letaba, Transvaal; also on Valencia oranges from Sunday's River, White River, Zebediela and Rustenburg (23 isolations).

Delphinium sp., from crown of wilting plant, Pretoria (Bottomley) and Qumbu, E. Griqualand.

Lathyrus odoratus L., from stems of yellowing seedlings (Ass. *Pythium* sp.) Brooklyn, Pretoria.

Mathiola incana R. Br., from stems of dying plants, Uitenhage, Sept. 1932 (Wilson); Durban (McClean) M.H. 28365.

Medicago sativa L., from stem of plant with rotting crown, Pietersburg, N. Transvaal (Wager).

Penstemon sp., from stems of wilting plants (ass. *Rhizoctonia*) Pretoria.

Phaseolus acutifolius Gray, from stems of Tepary bean plant, which was also infected with *Colletotrichum* sp., Immerpan, Springbok Flats, Transvaal (Sellschop).

Phaseolus sp., from stems of wilting plants in variety trials, Premier Cotton Estates, Mvamba.

Pisum sativum L., from stems of wilting plants (probably secondary to bacterial infection).

Rheum rhaponticum L., from crown of dying plant, Balfour, Transvaal, March 1930 (Wager) M.H. 28404.

Solanum tuberosum L., from tubers showing dry, sunken, discoloured patches, Belgian Congo; from stems of wilting plants (ass. *F. oxysporum f.* 1) Moorddrift, Transvaal; from stems of etiolated plants in greenhouse, Pretoria.

Nomadacris septemfasciata, on eggs of red locust hatching in sterilised soil, Pretoria 1932 (Brookes) M.H. 28364.

This form is widely distributed in humus, and on decaying parts of plants, in warm and temperate regions. It is recorded by Reinking and Wollenweber (39 p. 220) on rotted roots of *Citrus aurantifolia* Sw. in Central America.

Growth on Standard Media.

Oat agar : Aerial mycelium sparse, rather coarse, white to cartridge buff, tomentose; or aerial mycelium may be lacking. Pionnotes and groups of sporodochia developed freely, and were at first cartridge buff, becoming pinkish, and, after 8 weeks, sage green to deep grayish blue green.

Hard potato agar : Aerial mycelium not abundant, coarse, short, tomentose. Pionnotes developed along the needle track, and groups of sporodochia at the base of the slant; conidial masses were pinkish buff, becoming tinged deep bluish gray green to deep olive buff; in some tubes they were deep glaucous green.

Standard synthetic agar plus starch : No aerial mycelium. Pionnotes cartridge buff, or tinged grayish olive.

Potato agar plus 5 per cent. dextrose : Aerial mycelium short, coarse, tomentose, white to cartridge buff. Growth on substratum onion skin pink to vinaceous tawny or clay colour. Sporodochia pinkish buff, becoming deep olive buff or deep grayish blue green.

Potato plug : Mycelium covering the plug, short, rather coarse, loose, white to cartridge buff, sometimes with patches of dusky dull bluish green and deep delft blue. The plugs early became covered with a mass of closely crowded, pinkish buff sporodochia, which coalesced to form a dense pionnotes. The conidial masses became tinged greenish glaucous blue to dark bluish glaucous, and later Russian green to dusky dull green.

Melilotus stems : Mycelium rather scant, white, tomentose. Sporodochia pinkish buff, becoming tinged sage green.

Bean pod : Mycelium sparse, white, tomentose. Sporodochia and pionnotes pinkish buff, becoming pea green.

Rice : Mycelium white to cartridge buff, mealy, becoming tilleul buff to pinkish buff. Rice grains naples yellow to ochreaeous buff and cinnamon brown. Small sporodochia sometimes developed.

Measurements of Conidia.

Oat agar, culture 4 weeks old, conidia from pionnotes.

5-septate............	0·5 per cent........	55 × 5·5.
4-septate............	1·5 ,, ...	51–55 × 5–5·5.
3-septate............	72 ,, ...	32·5–52·5 × 4·4–5, mostly 37·5–45 × 5.
2-septate............	3 ,, ...	32·5–35 × 5.
1-septate............	8 ,,	
0-septate............	15 ,,	

Hard potato agar, culture 3 weeks old, conidia from pionnotes.

3-septate............	81·5 per cent........	30–47·5 × 4–5.
2-septate............	5 ,, ...	25–30 × 4–5.
1-septate............	6 ,, ...	15–25 × 3·2–5.
0-septate............	7·5 ,, ...	5–12·5 × 2·5–5.

Potato plug, culture 4 weeks old, conidia from sporodochia.

4-septate............	2·5 per cent........	40–45 × 4·7–5.
3-septate............	64 ,, ...	30–45 × 3·7–5.
2-septate............	3·5 ,, ...	27·5–32·5 × 3·75.
1-septate............	2 ,,	
0-septate............	28 ,,	

Bean pod, culture 2 weeks old, conidia from sporodochia.

5-septate............	17·5 per cent........	40–47·5 × 5–6.
4-septate............	50 ,, ...	35–45 × 4·5–5·5.
3-septate............	30 ,, ...	35–40 × 5–5·5.
2-septate............	0·5 ,,	
1-septate............	1 ,,	
0-septate............	1 ,,	

Fusarium coeruleum (Lib.) Sacc.

Saccardo, Syll. Fung. 4: 705, 1886. Wollenweber, Fus. aut. del. 407 410. Wollenweber and Reinking, Die Fusarien, 134, 1935.

Syn. *Selenosporium coeruleum* Libert in herb.

Fusarium violaceum Fuckel ; F. aeruginosum Del.

Fig. 48.

Fusarium coeruleum (Lib.) Sacc. ; conidia from (*a*) myclium of 8 weeks old culture on Melilotus stem, and (*b*) pionnotes of 6 weeks old culture on oat agar.

Conidia in sporodochia, in extended pionnotal layers, or scattered in the mycelium. Macroconidia almost straight or sub-falcate, with obliquely conical, ellipsoid or rounded apex, and base obtusely oval to mammillate, or with a papilla oblique to the longitudinal axis. Conidia in mass isabellinous-ochraceous to brownish white, sometimes taking a blue-violet to blue-black or wood green tinge from the stroma. Chlamydospores terminal or intercalary, 1-celled, spherical (9 μ) to pear-shaped (9 × 8) or 2-celled (14 × 9). Stroma effuse or verrucose, sclerotial, light or violet to blue-black. Conidia mostly 3-septate, less frequently 4–5-septate, exceptionally 0–2- or 6–7-septate.

0-septate............	16 × 4·7.	
1-septate............	21 × 4·7.	
3-septate............	21–47 × 3·5–6.......	Mostly 32–40 × 4·5–5·5.
5-septate............	42 × 5·2.	

Hab. *Solanum tuberosum* L., from tubers showing storage rot in a consignment from Hamburg, Germany, Dec. 1929 (Wager); also isolated by du Plessis (13) from rotting tubers, George, Paarl, Stellenbosch and Ceres, in the winter rainfall area.

No detailed notes were made of the cultural characters and conidial measurements of the strain studied.

ANNOTATED HOST INDEX.

A.—Fusaria on Flowering Plants.

Allium cepa L.

Foot rot, root rot and bulb rot.

Fusarium oxysporum f. 7.
F. vasinfectum v. *zonatum f.* 2.
F. moniliforme.
F. bulbigenum.

Decaying stem tissues.

F. scirpi and *F. scirpi* v. *filiferum.*

Bulb rot in storage.

F. moniliforme.
F. solani.
F. solani v. *Martii f.* 1.

F. oxysporum f. 7 has been found in the Transvaal and in the winter rainfall area (12). The other species, with the exception of *F. solani,* which has been isolated from rotting onions in the Cape Province (11) have, up to the present, only been recorded from the Transvaal; they are, however, cosmopolitan species (25, 61) and are probably more widely distributed than this would indicate.

Ananas comosus Merr.

Fruit rot.

Fusarium moniliforme.

This fungus was isolated from water soaked patches in pineapples; the lesions were more extensive and lighter brown than those caused by *Penicillium* sp. *Fusarium moniliforme* and its variety *subglutinans* have been found in decaying tissues of pineapples in Central America (59, 61).

Andropogon sorghum, see *Sorghum vulgare.*

Antirrhinum majus L.

Decaying stem tissues.

Fusarium oxysporum v. *aurantiacum.*

F. scirpi.

F. scirpi v. *compactum.*

According to Mes (27), the wilt of snapdragons in South Africa is caused by *Phytophthora cactorum ; Fusarium* spp. isolated from badly decayed tissues were not found to be a cause of wilt.

Apple, see *Pyrus.*

Arachis hypogaea L.

Pods and seeds.

Fusarium angustum.

F. oxysporum v. *aurantiacum.*

F. scirpi.

These fungi were isolated from pods and seeds attacked in the soil ; the pods from which *F. oxysporum* v. *aurantiacum* was isolated showed a pink discolouration of the shell.

Aster, see *Callistephus.*

Avocado, see *Persea.*

Bean, see *Phaseolus.*

Brachiaria, see *Gramineae.*

Bracken, see *Pteridium.*

Brassica oleracea L.

Decaying stems.

F. oxysporum v. *aurantiacum.*

F. moniliforme.

F. moniliforme v. *subglutinans.*

These fungi were isolated from stems of plants which had been attacked by *Rhizoctonia*, *Pythium* and aphides ; no true cases of "cabbage yellows" have been observed.

Bromus, see *Gramineae.*

Broom corn, see *Sorghum.*

Cabbage, see *Brassica.*

Callistephus chinensis Nees.

Wilted plants.

Fusarium conglutinans v. *callistephi.*

Decaying stems.

F. scirpi.

Aster wilt due to *F. conglutinans* v. *callistephi* is extremely prevalent in South Africa, and was probably introduced with seed imported from overseas. Only wilt-resistant varieties can be grown profitably (53, 55).

Campanula medium L.

Decaying stems.

Fusarium scirpi v. *compactum.*

Canterbury bell, see *Campanula.*

Carica papaya L.

Foot rot.

Fusarium bulbigenum v. *lycopersici.*

F. solani.

F. solani v. *Martii f.* 1.

Fruit rot.

F. lateritium.

F. scirpi.

F. stilboides.

Seedlings damping off.

F. oxysporum.

According to Wager (52), foot rot is caused by *Pythium* spp., and *Fusarium* or *Rhizoctonia* occur as a secondary cause of rot in decaying tissues; inoculations with *Fusarium* spp. did not give rise to foot rot. In Trinidad (2) a *Fusarium* sp. was found to cause a foot rot under moist conditions. *F. diversisporum* and *F. dimerum* v. *pusillum* act as wound parasites of papaw fruit in the Philippines (61).

Carnation, see *Dianthus.*

Centaurea cyanus L.

Discoloured stem tissues.

Fusarium vasinfectum v. *lutulatum.*

F. solani v. *Martii f.* 1.

Citrullus vulgaris Schrad.

Wilting plants.

Fusarium bulbigenum v. *niveum.*

Extensive wilting is reported in commercial plantings of watermelons. Varieties selected in America for wilt resistance (23) have been tested; Iowa Belle Round, Iowa Belle Long, Pride of Muscatine and Iowa King all showed considerable resistance under South African conditions; the highest degree of resistance was shown by Iowa Belle Round. Further variety tests are in progress.

Citrus spp. (**C. grandis** Osb., **C. limonia** Osb., **C. sinensis** Osb.).

Dry root rot.

Fusarium angustum.

F. solani.

F. solani v. *Martii f.* 1.

F. vasinfectum f. 2.

F. scirpi.

Bark on branches and twigs.

F. avenaceum f. 1.

F. lateritium.

F. lateritium v. *longum.*

F. scirpi.

F. scirpi v. *compactum.*

F. semitectum v. *majus.*

F. solani.

F. solani v. *Martii f.* 1.

Buds in nursery stock.

F. lateritium.

Decaying fruit.

F. angustum.
F. bulbigenum v. *lycopersici.*
F. decemcellulare.
F. equiseti.
F. lateritium.
F. lateritium v. *longum.*
F. moniliforme.
F. moniliforme v. *subglutinans.*
F. oxysporum.
F. sambucinum.
F. sambucinum f. 2.
F. scirpi.
F. scirpi v. *compactum.*
F. semitectum v. *majus.*
F. solani v. *Martii f.* 1.
F. stilboides.
F. vasinfectum f. 2.

Fusarium solani and *F. solani* v. *Martii f.* 1 were almost always found associated with dry root rot, frequently in conjunction with *F. angustum* or *F. vasinfectum f.* 2, but are also found on apparently sound roots and in soil in citrus orchards. None of the *Fusarium* spp. isolated from decaying roots was found to be capable of causing dry root rot. Of the species isolated from decaying fruit, *F. lateritium*, *F. moniliforme* plus v. *subglutinans*, *F. oxysporum*, *F. scirpi* plus v. *compactum*, *F. solani* v. *Martii f.* 1 and *F. vasinfectum f.* 2, on inoculation into oranges, produced extensive brown rots readily, if somewhat slowly. *F. lateritium*, *F. oxysporum* and *F. solani* v. *Martii f.* 1 were the most active rot-producing organisms (Plate I, IIa). *F. angustum*, *F. bulbigenum* v. *lycopersici*, *F. lateritium* v. *longum*, F. *sambucinum* plus *f.* 2, *F. semitectum* v. *majus* and F. *stilboides* rarely produced more than small, dry lesions around the point of inoculation. Only negative results were obtained by inoculating *F. decemcellulare* and *F. equiseti* into oranges.

Coffea arabica L.

Stem tissues of unthrifty plants.

Fusarium oxysporum.

Berries.

F. lateritium v. *longum.*
F. stilboides.

It is interesting to note that *F. lateritium* v. *longum* has been found to cause a bark disease of coffee in East Africa (44, 61). It is not known whether this organism occurs on bark in the Northern Transvaal; coffee is not now grown in that area on a commercial scale and few observations have been made.

Coffee, see *Coffea*.

Coral plant, see *Pentstemon*.

Cornflower, see *Centaurea cyanus*.

Cotton, see *Gossypium*.

Crotalaria juncea L.

Stems of wilted plants.

Fusarium sp. (*elegans* section).
F. scirpi.

A *Fusarium* sp. of the *elegans* section (probably belonging to the *F. vasinfectum* series) was isolated from stems of wilting plants of Sunn hemp and has been described. It occurs in Trinidad and India, and on *C. striata* in Uganda (4, 28, 46, 61).

Cucumber, see *Cucumis*.

Cucumis sativus L.

Rotting fruits

Fusarium scirpi.

F. scirpi v. *compactum.*

Stems of wilting plants.

F. equiseti.

F. scirpi.

Several species of *Fusarium* are recorded as causing rot of cucumber in temperate climates; they are wound parasites, namely *F. solani*, *F. orthoceras*, *F. reticulatum* and *F. culmorum* (61). The above-mentioned fungi were found in cucumbers affected with soft rot and leaking, in the sub-tropical conditions of the Eastern Transvaal.

Cucurbita pepo L. and **C. maxima** Duch.

Stems of wilting plants.

Fusarium javanicum.

Decaying stem tissues.

F. solani v. *Martii f.* 1.

Fusarium javanicum causes a foot rot of cucurbits, and is often responsible for serious losses in commercial plantings (9). It has been found occurring on pumpkin, marrow and Hubbard squash in the field. Inoculation experiments resulted in 70 per cent. to 100 per cent. infection of marrow, pumpkin, watermelon, spanspek (*Cucumis melo*) and cucumber plants. In the case of watermelons, a high percentage of plants of varieties resistant to the vascular wilt (*F. bulbigenum* v. *niveum*) succumbed to the attacks of this organism. The "Sugar Through" gourd, and a plant known locally as the "Maraka" (*Cucurbita pepo* var. *verrucosa*) proved to be resistant.

Cupressus lusitanica Mill.

Dying seedlings.

Fusarium oxysporum v. *aurantiacum.*

This fungus is known in Europe and North America as a cause of damping off in coniferous seedlings (61).

Cynodon, see *Gramineae.*

Cypress, see *Cupressus.*

Dahlia pinnata Cav.

Dying seedlings.

Fusarium sp. (*elegans* section).

This fungus was associated with *Rhizoctonia* sp. and *Pythium* sp.

Darnel, see *Gramineae.*

Datura stramonium L.

Stems of wilting plants.

Fusarium sp. (*elegans* section).

Delphinium Ajacis L.

Decaying stem tissues.

Fusarium solani v. *Martii f.* 1.

Dianthus caryophyllus L.

Stems of wilting plants.

Fusarium dianthi.

Foot rot and crown rot.

F. bulbigenum v. *lycopersici.*
F. scirpi.
F. scirpi v. *acuminatum.*
F. semitectum v. *majus.*
F. solani.

Severe losses from carnation wilt are recorded from Natal and the Northern Transvaal (47). The organism found in wilting plants from these areas agrees morphologically with *F. dianthi*, and has been shown to cause wilt in carnation seedlings artificially inoculated. Fungi found in tissues of plants affected with crown rot usually attack carnations growing under unsuitable climatic or cultural conditions.

Digitaria, see *Gramineae.*

Dimorphotheca aurantiaca D.C.

Plants affected by foot rot.

Fusarium sp. *undet.*

Drabok, see *Gramineae.*

Euphorbia crassipes Marloth.

Rotting stems.

Fusarium avenaceum f. 1.
F. lateritium.
F. moniliforme.
F. scirpi.

Fusarium lateritium was also isolated from the fleshy stem of *Euphorbia obesa.*

Fragaria sp.

Foot rot.

Fusarium sp. undet.

In North America and in England, root rot of strawberries is caused by *F. orthoceras* (61) and other species. The African disease needs further study.

Freesia refracta Klatt.

Corms showing dry rot.

Fusarium bulbigenum.

The internal tissues of the corms were light brown, and there was a white, powdery deposit on the exterior of the corms when dry ; a similar rot occurs in America (45).

Geranium, see *Pelargonium.*

Gilia rubra Heller.

Foot rot.

Fusarium solani.
Fusarium sp. undet. (*elegans* section).

A *Pythium* sp. was present in all affected plants, and it is likely that the *Fusarium* spp. were a secondary form of decay.

Gladiolus spp.

Rotting corms.

Fusarium oxysporum v. *gladioli.*

F. bulbigenum.

F. solani.

Fusarium oxysporum v. *gladioli* was isolated from corms and leaf bases of cultivated varieties. The first sign of disease was the browning of the younger leaves ; affected plants failed to flower. The corms were firm, but showed a brown discolouration, especially near the base. The organism agrees morphologically with *F. oxysporum* v. *gladioli* (28, 61) but its identity needs confirmation by inoculation experiments. *Fusarium solani* was present in the same corms and was probably a secondary cause of decay. *F. bulbigenum* was isolated from corms of an indigenous species growing in the veld in the northern Transvaal.

Goose grass, see *Gramineae.*

Gossypium sp.

Foot rot.

Fusarium angustum.

F. moniliforme.

Fusarium moniliforme is recorded as a cause of foot rot of cotton in the United States (61). The presence of *F. vasinfectum* in wilted cotton plants in South Africa is unproven, although records exist of the occurrence of a *Fusarium* in the vascular bundles of wilted plants. No opportunity has occurred, during the present investigation, of identifying this organism. Boll rots associated with *Fusarium* spp. have also been observed, but no suitable material has been obtained for investigation during the past few years.

Gramineae.

Foot rot of *Eleusine indica* Gaertn. (goose grass).

Fusarium avenaceum.

F. moniliforme.

Foot rot of *Lolium temulentum* L. (darnel, drabok).

F. culmorum.

Ovaries of grasses infected with smut or ergot.

F. avenaceum f. 1.

F. heterosporum v. *congoense.*

Ovaries of *Brachiaria pubifolia.*

F. chlamydosporum.

Fusarium heterosporum v. *congoense* occurs very commonly, forming a pink incrustation on the ovaries of various grasses, especially when they are infected with smut or ergot; the fungus has been found on the ovaries of *Brachiaria, Bromus, Cynodon, Digitaria, Hyparrhenia, Panicum, Pennisetum, Setaria* and *Sorghum.* *F. avenaceum f.* 1 occurs frequently on ovaries of *Paspalum* spp. which are infected with *Claviceps paspali.*

Grapefruit, see *Citrus.*

Grape vine, see *Vitis.*

Grasses, see *Gramineae.*

Hibiscus sabdariffa L.

Stems of wilting plants.

Fusarium vasinfectum.

Fusarium vasinfectum is reported as a cause of wilt of *Hibiscus cannabinus* in Tanganyika Territory (22) and the same fungus probably causes a wilt of okra, *Hibiscus esculentus* L. (61).

Hubbard squash, see *Cucurbita.*

Hyparrhenia, see *Gramineae.*

Indian sorrel, see *Hibiscus.*

Ipomoea batatas Lam.
Surface rot of tubers.
Fusarium oxysporum.

This fungus was isolated from small, dry, discoloured, somewhat sunken patches on the tubers (18).

Ipomopsis, see *Gilia.*

Kaffir corn, see *Sorghum.*

Kentia sp.
Stem of dying palm.
Fusarium scirpi.

Kniphofia sp.
Capsules.
Fusarium moniliforme v. *subglutinans.*

Lathyrus odoratus L.
Foot rot of seedlings and mature plants.
Fusarium vasinfectum v. *lutulatum.*
Fusarium oxysporum.
F. scirpi.
F. scirpi v. *compactum.*
F. solani v. *Martii* *f.* 1.

Fusarium vasinfectum v. *lutulatum* was always found in the yellowing and drying stems of affected plants. The other organisms were apparently secondary causes of decay.

Larkspur, see *Delphinium.*

Lemon, see *Citrus.*

Limonium sp.
Foot rot.
Fusarium scirpi.
F. scirpi v. *compactum.*

Lucerne, see *Medicago.*

Lycopersicum esculentum Mill.
Stems of wilting plants.
Fusarium bulbigenum v. *lycopersici.*

Decaying stem tissues.

Fusarium angustum.
F. equiseti.
F. sambucinum.
F. scirpi.
F. vasinfectum v. *zonatum f.* 1.

Discoloured vascular tissue in fruit.

F. bulbigenum v. *lycopersici.*

Rotting fruit.

F. scirpi.

Seed.

Fusarium bulbigenum v. *lycopersici.*
F. equiseti.
F. moniliforme.
F. redolens f. 1.

The wilt caused by *Fusarium bulbigenum* v. *lycopersici* is very prevalent in the tomato growing areas of the eastern Transvaal. A number of varieties selected in America for wilt resistance have been tested and the varieties Stone and Marvel were found the most suitable for Transvaal conditions; further selections are being made from these varieties (49, 50, 51, 54). The organisms found in decaying stem tissues were usually associated with *F. bulbigenum* v. *lycopersici*, with *Rhizoctonia* sp., *Pythium* sp., or with *Bacterium solanacearum*. The rotting organisms entered the fruit through wounds, "blossom end rot," or through cracks at the stem end. *F. scirpi* frequently causes a browning of the core of apparently sound fruit. Several species were isolated from seed offered for sale by local seedsmen; most of this seed is imported from America, and several of the fungi found on the seed are causes of rot in tomato fruit.

Maize, see *Zea.*

Marrow, see *Cucurbita.*

Matthiola incana R. Br.

Stems of yellowing and wilting plants.

Fusarium scirpi.
F. scirpi v. *compactum.*
F. solani v. *Martii f.* 1.
F. vasinfectum f. 2.

Medicago sativa L.

Decaying stem tissues.

Fusarium angustum.
F. solani v. *Martii f.* 1.

These fungi were isolated from decaying tissues of plants affected by crown rot; they were usually plants growing in heavy soil and indiscreetly irrigated. *Neocosmospora vasinfecta* was also obtained from the same source.

Mesembrianthemum sp.

Rotting stems of succulent species.

Fusarium avenaceum f. 1.
F. equiseti v. *bullatum.*
F. vasinfectum f. 2.

Musa Sapientum L.

Fruit.

Fusarium moniliforme.
F. semitectum v. majus.
F. scirpi.

Fusarium monilforme was isolated from the internal tissues of fruit shewing "finger tip rot." Hansford (17a) records finger tip rot of several varieties of banana in Uganda caused by this organism. The other two species mentioned were growing on the surface of the rotting fruit.

Nasturtium, see *Tropaeolum*.

Nicotiana tabacum L.

Dying seedlings.

Fusarium moniliforme.

Stems of wilting plants.

F. oxysporum v. *nicotianae.*
F. bulbigenum.

In several publications, tobacco wilt occurring in the western Transvaal has been attributed to *Fusarium oxysporum* v. *nicotianae*, on account of the presence of a Fusarium mycelium in the vascular system and the similarity of the symptoms to those of the American tobacco wilt (19, 20). During the season 1925–1926, wilt was pronounced in the western Transvaal, probably as a result of spells of hot, dry weather. When wilt is severe, all leaves droop, turn yellow and die within a few days. Often only one lateral root is affected and leaves on that side of the plant alone are affected, the others remaining normal. Wilting is accompanied by a darkening of the wood from the roots upwards. *Fusarium bulbigenum* was isolated as a pure culture from all parts of the discoloured wood—from root to petiole. Its pathogenicity has not yet been proved by inoculation, so that it is not known whether this strain of *F. bulbigenum* is a specific vascular parasite of tobacco. In later publications this fungus is referred to as *Fusarium* sp. (29, 30, 32). More recently a *Fusarium* sp. morphologically identical with *F. oxysporum* v. *nicotianae* was isolated from tobacco plants from the Rustenburg district; this fungus caused wilting in tobacco seedlings after inoculation. The role of *Fusarium* spp. in causing tobacco wilt in South Africa is in need of investigation. The "Kromnek" disease, previously known as the "Kat River wilt," on investigation proves to be a virus disease very similar to spotted wilt of tomatoes, etc. The "wilt" in Turkish tobacco, serious in 1926 in the western Cape Province, was also probably "kromnek" (31).

Onion, see *Allium*.

Orange, see *Citrus*.

Panicum, see *Gramineae*.

Papaver nudicaule L. and **P. Rhoeas** L.

Foot rot.

Fusarium scirpi.
F. scirpi v. *compactum*.

Iceland poppies and Shirley poppies are grown in the Transvaal for winter and early spring flowering. When the temperature rises in the late spring, the leaves often yellow, and the stems rot. The stem tissues are found to be invaded by a *Pythium* sp. and *Rhizoctonia* sp. associated with the Fusaria mentioned above.

Pawpaw, see *Carica*.

Pea, see *Pisum*.

Peach, see *Prunus*.

Peanut, see *Arachis*.

Pelargonium sp.
Rhizome, showing firm, brown type of rot.
Fusarium javanicum v. *radicicola*.

Pennisetum, see *Gramineae*.

Penstemon sp.
Decaying stems.
Fusarium solani v. *Martii* *f*. 1.
Fusarium sp. undet.

From stems of plants showing foot rot, associated with *Rhizoctonia* sp.

Persea americana Mill.
Roots.
Fusarium moniliforme.
Fusarium sp. undet. (*elegans* section).

These fungi were found in roots of an avocado tree which was dying back from the tips of the branches, and also from the soil of the orchard ; a *Phytophthora* sp. was also isolated.

Phaseolus vulgaris L. and **Ph. acutifolius** Gray v. **latifolius** Freem.
Foot rot.
Fusarium oxysporum v. *aurantiacum*.
F. scirpi v. *acuminatum*.
F. solani.
F. solani v. *Martii* *f*. 1.

The plants from which these fungi were isolated showed yellowing and wilting of the leaves and stems, but the specific " dry root rot " organism (*F. solani* v. *Martii* *f*. 3) was not isolated. *F. solani* was found in stems of Tepary bean, the other species were isolated from French bean plants.

Phlox Drummondii Hook.
Foot rot.
Fusarium moniliforme.
F. scirpi.

These fungi were associated with *Rhizoctonia* sp. in the decaying stem tissues.

Physalis angulata.
Wilting stems.
Fusarium sp. undet.

Pineapple, see *Ananas*.

Pinus spp.
Dying seedlings.
***Fusarium oxysporum* v. *aurantiacum*.**
***F. scirpi*.**

Discoloured wood.

F. angustum.

From dying seedlings of *Pinus palustris*, *Pinus taeda* and *P. longifolia* from Zululand and the northern Transvaal. *F. oxysporum* v. *aurantiacum* is known in Europe as a cause of "damping off" in seedlings of Conifers.

Pisum sativum L.

Stems of wilting plants.

Fusarium oxysporum f. 8.
F. vasinfectum v. *lutulatum*.
Fusarium sp. undet. (*elegans* section).
Fusarium moniliforme
Fusarium moniliforme v. *subglutinans*.
F. scirpi.
F. solani v. *Martii f.* 1.

The last four fungi are probably organisms which are saprophytic on decaying stem tissues. Only one set of isolations studied agreed morphologically with *F. oxysporum f.* 8 (48, 61) but a number of strains of Fusaria of the *elegans* section were not obtained in good sporulating condition and could not be identified. The *Fusarium* wilt of peas in this country needs investigation. *Fusarium vasinfectum* v. *lutulatum* was isolated from wilting seedlings, and from plants which did not wilt but failed to set seed. This fungus has been mentioned as a cause of wilt in America (24). For a discussion of the causes of pea wilt in Europe and America, see Wollenweber and Reinking (61).

Polygala virgata.

Stem of wilting plant.

Fusarium angustum.

Poppy, see *Papaver*.

Potato, see *Solanum*.

Prunus persica Sieb. et Zucc.

Rotting fruit.

Fusarium lateritium.
Fusarium sp. undet. (*elegans* section).

The undetermined organism invaded fruit which had been severely attacked by "freckle" (*Cladosporium carpophilum*).

Pteridium aquilinum.

Dying stems.

Fusarium scirpi.

associated with *Pestalotia* sp. and *Pythium* sp.

Pumpkin, see *Cucurbita*.

Pyrus malus L.

Core rot of fruit.

Fusarium moniliforme.
F. moniliforme v. *subglutinans*.
F. scirpi.

In Europe and America, core rot is attributed to *F. avenaceum* and *F. lateritium* and less frequently to *F. oxysporum* v. *aurantiacum* and *F. lactis* (61). The chief cause of core rot in South Africa appears to be *Penicillium expansum*.

Red hot poker, see *Kniphofia*.

Rheum rhaponticum L.
Decaying stems.
Fusarium solani v. *Martii f.* 1.
Fusarium undet. (*elegans* section).

These fungi were found in rhubarb stems which had succumbed to the attack of *Phytophthora parasitica* v. *rhei*.

Rhubarb, see *Rheum*.

Saccharum officinarum L.
Dying leaf.
Fusarium moniliforme v. *subglutinans*.

For a discussion of the diseases caused by *F. moniliforme* and its variety *subglutinans*, see Wollenweber and Reinking (61). The Pokkah-boeng disease of sugar cane has not been observed in Natal.

Sesamum orientale L.
Stems of wilting plants.
Fusarium vasinfectum f. 2.

A wilt of *Sesamum* has been reported from Turkestan, India and Japan, and is attributed to a *Fusarium* sp. morphologically similar to *F. vasinfectum* (61). No infection experiments were carried out with the strain isolated from South African plants.

Setaria, see *Gramineae*.

Snapdragon, see *Antirrhinum*.

Solanum tuberosum L.
Stems of wilted plants and discoloured vascular ring in tubers.
Fusarium oxysporum f. 1.
Black rot of tubers.
F. javanicum v. *radicicola*.
Storage rot of tubers.
F. coeruleum.
F. moniliforme.
F. orthoceras.
F. oxysporum.
F. scirpi.
F. scirpi v. *acuminatum*.
F. solani.
F. solani v. *Martii f.* 1.

Fusarium orthoceras appears to be the organism most commonly causing storage of potato tubers in South Africa. It was found in firm tissues with light brown discolouration, in superficial depressed areas and occasionally in tissues affected with a soft form of rot. For a discussion of *Fusarium* spp. causing wilt and various forms of tuber rot, see Wollenweber and Reinking (61), where an extensive bibliography will also be found.

Sorghum vulgare Pers. v. **caffrorum** (Thun.) Hubb. et Rehder.
Heads moulding in sheath before unfolding.
Fusarium moniliforme.
Pink incrustation on smutted heads.
F. culmorum.
F. heterosporum v. *congoense.*

Sorghum vulgare Pers. v. **technicum** (Koern.) Job.
Stems showing foot rot.
Fusarium moniliforme.

Squash, see *Cucurbita.*

Statice, see *Limonium.*

Stinkblaar, see *Datura.*

Stock, see *Matthiola.*

Strawberry, see *Fragaria.*

Striga lutea Lour.
Stems and roots of dying plants.
Fusarium equiseti.
F. moniliforme.
F. scirpi v. *compactum.*
F. semitectum v. *majus.*
Fusarium sp. undet. (*elegans* section).

The plants from which these fungi were isolated had been treated with a so-called "witchweed eradicator." It was claimed that maize fields treated with this eradicator were cleared of witchweed, which was attacked and killed by a parasitic fungus. Witchweed plants were treated with this preparation, and a percentage succumbed under very humid conditions. No specific organism was found in the affected plants, but the Fusaria named above were isolated, and also species of *Pythium*, *Rhizoctonia* and *Pestalotia*. These fungi are apparently saprophytes, or weak parasites which are only able to attack the plants under very humid conditions.

Sugar cane, see *Saccharum.*

Sunn hemp, see *Crotalaria.*

Sweet pea, see *Lathyrus.*

Sweet potato, see *Ipomoea.*

Sweet sultan, see *Centaurea.*

Tobacco, see *Nicotiana.*

Tomato, see *Lycopersicum.*

Triticum sp.
Foot rot.
Fusarium culmorum.
Stems of plants with blind ears.
F. moniliforme.
Glumes of stunted plants with deformed ears.
F. semitectum v. *majus.*

For a discussion of Fusaria in connection with wheat diseases, and for a bibliography, see Wollenweber and Reinking (61).

Tropaeolum majus L.
Stem of wilting plant.
Fusarium solani.

associated with *Pythium* sp.

Viscaria viscosa Aschers.
Decaying stem tissues.
Fusarium scirpi.

Vitis vinifera L.
Mycelial growth on bark.
Fusarium scirpi v. *acuminatum.*

Watermelon, see *Citrullus.*

Wheat, see *Triticum.*

Witchweed, see *Striga.*

Zea mays L.
Foot rot, root rot, and cob mould.
Fusarium moniliforme.
F. moniliforme v. *subglutinans.*
F. graminearum (*Gibberella saubinetii*).
Decaying stems and roots.
F. solani.
F. scirpi v. *acuminatum.*

Foot rot and cob mould due to *Fusarium* spp. are very common and widespread diseases of maize in South Africa.

B.—Fusaria on Other Fungi.

Hypocreales.

Epichloë Zahlbruckneriana.
Fusarium ciliatum.
F. decemcellulare.

Claviceps spp.
F. avenaceum f. 1.
F. heterosporum v. *congoense.*

Basidiomycetes.

Uredineae.
Puccinia ranulipes.
Fusarium avenaceum.

Ustilagineae.
F. heterosporum v. *congoense.*
F. culmorum.

C.—Fusaria on Insects.

Aspidiotus furcillae (hidden sclae) on *Acacia*.
Fusarium coccophilum.

Aspidiotus perniciosus (pernicious scale) on *Pyrus*.
Fusarium coccophilum.

Aspidiotus rapax (greedy scale) on *Ribes*.
Fusarium coccophilum.

Ceroplastis sp. (waxy scale) on *Acacia*.
Fusarium lateritium.

Chionaspis sp. on indigenous tree.
Fusarium coccophilum.

Chrysomphalus aurantii (red scale) on *Citrus* and *Rosa*.
Fusarium coccophilum.

Glossina sp. (Tsetse fly).
Fusarium semitectum v. *majus*.

Icerya purchasi (Australian bug) on *Mentha*.
Fusarium scirpi.

Lepidosaphes Gloveri (mussel scale) on *Citrus*.
Fusarium coccophilum.
F. sambucinum.
F. sambucinum f. 2.
F. lateritium.

Nomadacris septemfasciata (red locust).
F. sambucinum f. 6.
F. scirpi.
F. scirpi v. *acuminatum*.
F. scirpi v. *filiferum*.
F. semitectum v. *majus*.
F. solani v. *Martii f.* 1.

Fusarium coccophilum occurs very commonly on scale insects in the more humid areas near the south-east coast and in the northern and eastern Transvaal; it is an important factor in reducing scale infestation. It does not occur where humidity is low, and experience in other countries has shown that it is useless to try to introduce the fungus into areas where conditions are unsuitable (35, 60).

D.—Fusaria on Animal Products.

Eggs.
Fusarium moniliforme.
F. semitectum v. *majus*.

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Explanation of Plates.

Plate I. Fusarium-rot of oranges, caused by artificial inoculation with (*a*) *Fusarium lateritium* and (*b*) *Fusarium solani* var. *Martii f.* 1; photographed in each case about 4 weeks after inoculation.

Plate II. (*a*) Fusarium-rot of orange, caused by artificial inoculation with *Fusarium oxysporum;* photographed 4 weeks after inoculation.

(*b*) Section through perithecia of *Gibberella Saubinetii*, (× 75).

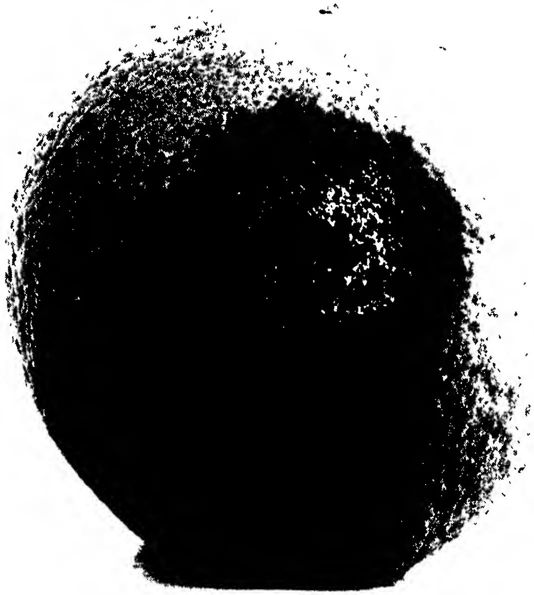
Plate III. Branch of orange tree infested with red scale, which has been attacked by *Fusarium coccophilum*. (Natural size).

Plate IV. (*a*) Detail from the branch shown in Plate III, showing *F. coccophilum* growing out of the margin of the scale. (× 10).

(*b*) Section through sporodochium of *F. coccophilum*, taken from specimen shown in Pl. 3 (× 150).

INDEX TO SPECIES AND SYNONYMS.

Italicised numbers indicate pages with illustrations.



a.

Plate I.

b.

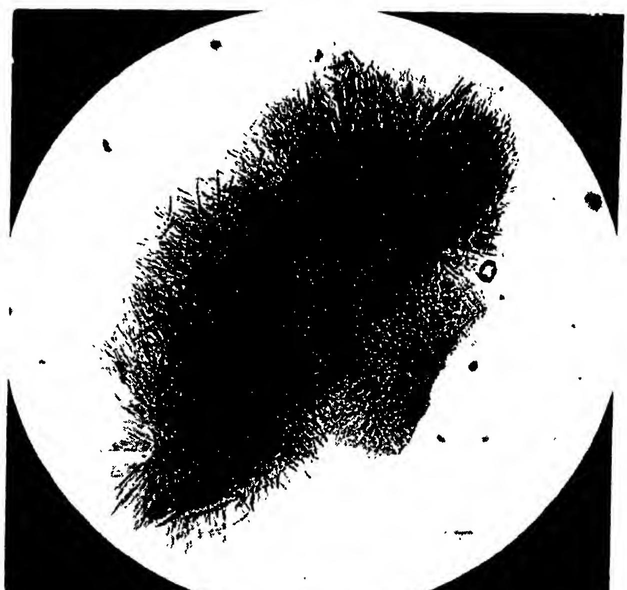
Plate I.

a.

b.

PLATE II.

PLATE III.



b.

PLATE IV.

Bothalia

A RECORD OF

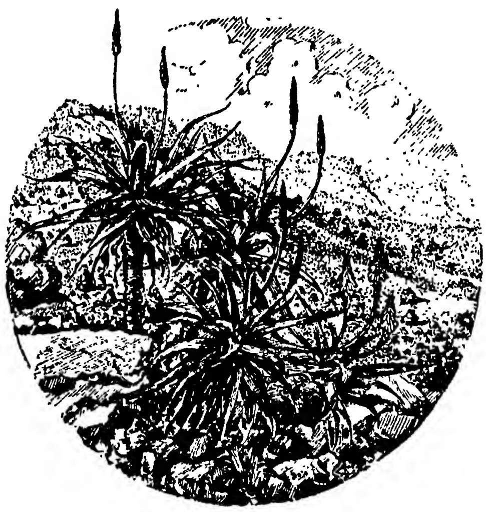
CONTRIBUTIONS

FROM THE

NATIONAL HERBARIUM

UNION OF SOUTH AFRICA

PRETORIA



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CONTENTS.

SOUTH AFRICAN RUST FUNGI, III.

by

E. M. Doidge.

[The first paper of this series, entitled "A Preliminary Study of the South African Rust Fungi" constituted Part Ia of Vol. 2 of Bothalia (1927). South African Rust Fungi II appeared in Vol. 2 Part 2 (1928)].

Aecidium Burtt-Davyi nov. spec.

Aecidiis foliicolis et petiolicolis, matricem incrassatis, plerumque dense confertis, cylindraceis, usque 2 mm. longis, 300-400 μ latis, pallide flavis, primo clausis dein apertis margine erecto vix lacerato; cellulis peridie arctissime conjunctis, irregularibus, 25–42·5 × 10–20 μ, pariete exteriore striato 8–15 μ crasso, interiore striato-verrucoso 4–5 μ crasso; sporis subglobosis, ovatis, ellipsoideis v. oblongis, saepe irregularibus et angulatis, subtilissime verruculosis, 21–43 × 16–22·5 μ, episporio ubique 2–2·5 μ crasso, poris germinationis obscuris.

Hab. in foliis petiolisque *Acaciae stoloniferae* Burch., Christiana, leg. Burtt Davy, 1973 et 5581.

This may possibly be the aecidial stage of *Ravenelia modesta* (q.v.) which occurs on the same host, but the aecidium and the teleuto-form were collected in widely separated localities and no connection between the two forms has yet been established.

Aecidium Dinteri nov. spec.

Pycnidiis minutis, superficialibus, inter aecidia distributis, applanato-hemisphericis, melleo-brunneis, 50–75 μ diam.

Aecidiis ramicolis et petiolicolis, ramulos incrassatos et uncinatos plus minus contortos dense aequaliterque distributis, longe exsertis, tubulosis, 2·5–4 μ altis, 250–300 μ latis, pallide flavo-brunneis, diu clausis, tandem apertis, margine pallidiore, leniter recurvato, denticulato: cellulis peridie arctissime conjunctis, quoad formam valde variabilis, saepe rectangularibus v. irregulariter rhomboideis, 25-43 × 15–20 μ, pariete exteriore striato, 12–15 μ crasso, interiore striato-verrucosa 3·5–5 μ crasso. Sporis irregularibus plerumque angulato-globosis oblongis v. ellipsoideis, 25–32·5 × 17·5–22·5 μ, dense minuteque verruculosis, subhyalinis; episporio 2·5-3 μ crasso, poris germinationis sparsis (usque 8) praedito.

Hab. in ramis petiolisque *Acaciae uncinatae* Engl., Otjihavera-Okapuka, S.W. Africa, leg. *Dinter* 3488 (ex. Herb. Marloth) 26686.

Aecidium litakunensis nov. spec.

Pycnidiis inter aecidiis sparsis, melleis, applanato-hemisphericis, 60-100 μ diam.

Aecidiis foliicolis et ramicolis; in foliis petiolisque gallas subglobosas usque oblongas, plus minus flexuosas et distortas, magnitudine variabiles, 2–4 cm. longas, 5–15 mm. crassas formantibus, dense confertis, cylindraceis, usque 1·5 mm. longis, 350-500 μ latis, flavidis v. flavo-brunneis, diu clausis; cellulis peridie irregularibus, 20–37·5 × 7·5-17·5 μ, pariete exteriore striato 12–15 μ crasso, interiore striato-verrucoso 3–5 μ crasso. Sporis globosis, ovatis, ellipsoideis v. oblongis, saepe irregularibus et angulatis, verruculosis, pallide flavidis v. subhyalinis, 22–30 × 17–22 μ, episporio ubique 1·5–2 μ crasso, poris germinationis obscuris.

Hab. in foliis *Acaciae litakunensis* Burch., inter Rustenburg et Northam, leg. Scott, 27294; Bechuanaland leg. Burtt Davy, 2443.

Aecidium Moggii nov. spec.

Pycnidiis amphigenis sed plerumque epiphyllis, copiose evolutis, inter aecidia distributis vel per magnam folii partem aequaliter dispositis, ex flavidis tandem nigrescentibus, 90–130 μ diam.

Aecidiis hypophyllis, singulis subinde epiphyllis, plerumque per totam folii superficiem dense aequaliterque distributis, cupulatis, 200–250 μ diam., margine laciniato; cellulis peridie fere quadraticis usque rhomboideis, 20–35 × 10–20 μ, pariete exteriore striato 5–6 μ crasso, interiore verrucoso 3–5 μ crasso. Sporis angulato-globosis, oblongis v. late ellipsoideis, minutissime verruculosis, subhyalinis, 17–22·5 × 15–20 μ, episporio 1·5–2 μ crasso.

Hab. in foliis *Senecionis coronati* Harv., Pretoria, leg. Mogg, 23636.

Aecidium tetragoniae nov. spec.

Pycnidiis amphigenis, inter aecidia copiose sparsis, melleis dein atro-brunneis, 120–180 μ diam.

Aecidiis amphigenis, totam folii superficiem vel magnam ejus partem dense aequaliterque obtegentibus, diu hemispherico-clausis, tandem apertis cupulatis, 300–400 μ diam., margine albido laciniato mox evanescente; cellulis peridie laxe conjunctis, irregularibus, 27–42 × 15–25 μ, pariete exteriore striato 5–8 μ crasso, interiore verrucoso 2–3 μ crasso. Sporis sub-globosis, oblongis, ellipsoideis vel ovatis, plerumque angulatis, 20–32·5 × 15–20 μ; episporio 2·5–5 μ crasso, dense minuteque verruculoso.

Hab. in foliis *Tetragoniae arbusculae* Fenzl., Fauresmith, leg. Henrici, 25892.

Masseeëlla flueggeae Syd.

in Ann. Myc. 26 (1928) 424.

Syn. *Uredo brideliae* (P. Henn. et Evans) Doidge in Bothalia 2 (1927) 193.

Aecidium brideliae P. Henn. et Evans in Engl. Bot. Jahrb. 41 (1908) 272; Syd. Monogr. Ured. 4 (1924) 186.

Uredo-sori hypophyllous, on small leaf spots which may be indistinct, or yellow to yellow-brown, irregularly scattered or in groups of 2–8, long covered by the discoloured, yellow-brown epidermis, very minute, 200–350 μ diam. Uredospores subglobose, ovate or ellipsoid, borne singly, 17–26 × 14–20 μ; epispore hyaline, 1·5–2 μ thick, minutely verruculose-echinulate, germ pores obscure.

Teleuto-sori epiphyllous—very rarely a single one occurs on the under side of the leaf—deeply immersed, in small or larger groups, or even solitary, minute; the spores protrude from the sori in filiform columns 1–2·5 mm. long and 50–90 μ broad, these are usually curved and become dark brown when dry. Teleutospores ovate or ellipsoid, often slightly angular, 1-celled, smooth, deep yellow or golden yellow, embedded in a mucous mass, 22–30 × 15–21 μ; epispore about 3 μ thick with a distinct apical germ pore.

Hab. on leaves of *Fluggea virosa* (Roxb.) Baill. (= *Fluggea microcarpa* Blume) near Nelspruit, *Burtt Davy*, 77; Nelspruit, *Liebenberg*, 25968; Schagen, *Liebenberg*, 26359.

In Bothalia (loc. cit.) it was pointed out that number 77 was a uredo-form; more recently the teleuto-stage has been collected by Liebenberg, and it agrees in every detail with the fungus described by Sydow on *Fluggea virosa* from the Philippines.

Puccinia bylianum Dippenaar.

in the South African Journ. Sci. 28 (1931) 288.

Syn. *Aecidium bylianum* Syd. in Ann. Myc. 22 (1924) 236; Bothalia 2 (1927) 172.

Aecidia hypophyllous or caulicolous, developing on thickened and sometimes distorted parts of the host plant, sub-seriate or in densely crowded, elongated groups 1–2 cm. long (fide Sydow, amphigenous, chiefly hypophyllous, on yellow leaf spots, closely crowded in

groups 3–8 mm. diam.) immersed, cupulate, 250–300 μ diam., margin erect, white, lacerate. Cells of the peridium firmly compacted, rhomboid, 20–30 × 10–16 μ; outer wall striate, 6–10 μ thick, inner verrucose 3–5 μ thick. Spores angular-globose, subhyaline, 10–18 μ diam., epispore very delicately verruculose, about 1 μ thick.

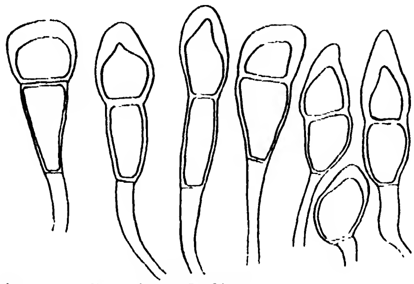


Fig. 1.—*Puccinia bylianum*, teleutospores.

Teleuto-sori caulicolous, rarely on the leaves, scattered or in groups, often developing between the aecidia, long covered by the raised epidermis, which finally splits longitudinally, oblong, about ½ mm. long, sometimes becoming confluent and up to 4 mm. long, black. Teleuto-spores oblong, ellipsoid or subclavate. 35–52·5 × 12·5–22·5 μ, light brown, darker at the apex; apex rounded, truncate or obtusely acuminate, often oblique, attenuate at the base, constricted at the septum; epispore smooth, 1·5–2 μ thick, thickened at the apex up to 8 μ; pedicel persistent, up to 42 μ long, subhyaline or light brown, 5–6 μ thick. Mesospores fairly numerous, elipsoid to subclavate, 25–33 × 15–17·5 μ; epispore similar to that of the teleutospores. An occasional 3-septate spore was seen.

Hab. on leaves and stems of *Senecio Burchellii* DC., Bloemfontein, *Potts*, 24875 (Grey. Univ. Coll. No. 8017); T. Pretoria, *Fuller*, 15018.

In Bothalia 2 (1927) 171, the aecidial stage (No. 15018) was recorded as *Aecidium incertum* Syd. on *Senecio laevigatus* Thun. On comparison, the host of this number proves to be the closely similar species *Senecio Burchellii*, and the aecidium is identical with that of the plant on which teleuto-sori were found.

The aecidium closely resembles *Aecidium incertum* Syd., which was first described on *Senecio napifolius*; no teleutosori have yet been found on the latter host, so that it is impossible to say whether *Aecidium incertum* Syd. is a synonym for *Puccinia bylianum*.

Although the teleutospores of the Orange Free State specimen are somewhat smaller, there can be no doubt that this is the rust found in the winter rainfall area, and described by Dippenaar as occurring on *Senecio* spp., *Senecio littoreus*, *S. pinnulatus*, *S. vulgaris* and *S. bipinnatifida* from Ceres, Hopefield, Knysna and Stellenbosch.

This species differs widely from *Puccinia pentactina* described as occurring on *Senecio pentactinus* [Bothalia 2 (1928) 473].

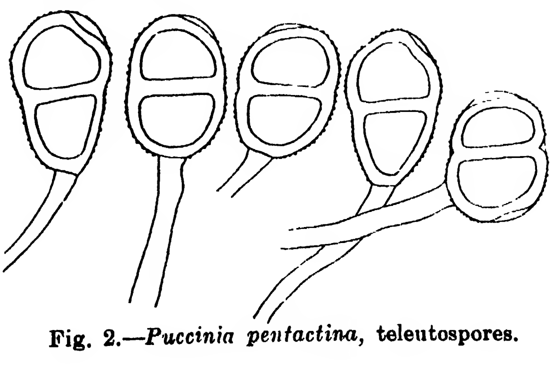


Fig. 2.—*Puccinia pentactina*, teleutospores.

Puccinia Liebenbergii nov. spec.

Aecidiis hypophyllis, maculis brunneolis 1–2 mm. diam. insidentibus, 3–7 in centro macularum aggregatis, cupulatis, 200-250 μ diam., margine albido reflexo laciniato ; cellulis peridie laxiuscule conjunctis, rhomboideis, 20-25 × 15–18 μ, pariete exteriore striato, 2–4 μ crasso, interiore verrucoso, 2–5 μ crasso. Aecidiosporis angulato-globosis v. ellipsoideis, dense et subtilissime verruculosis, subhyalinis, 12-20 × 11–15 μ, episporio 1 μ crasso.

Soris uredosporiferis amphigenis, plerumque epiphyllis, per totam folii superficiem plus minusve dense sparsis, interdum circa aecidia annula efficientibus, minutis, rotundatis, usque ½ mm. diam., epidermide bullata diu tectis, dein poro rotundo centrali apertis, cinnamomeo-brunneis. Uredosporis subglobosis v. ovatis, flavo-brunneolis, ubique aequaliter et sat valide aculeatis, 20-25 × 20–21 μ, episporio 1·5–2 u crasso, poris germinationis obscuris.

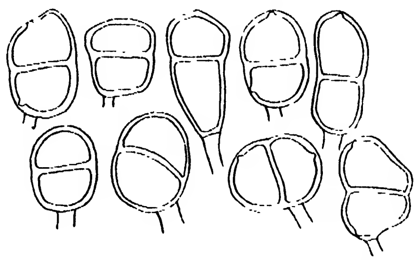


Fig. 3.—*Puccinia Liebenbergii*, teleutospores.

Soris teleutosporiferis conformibus, atro-brunneis, vel teleutosporis in soris uredosporiferis immixtis. Teleutosporis ellipsoideis, sub-globosis v. irregularibus, levibus, brunneis, 27·5–40 × 20–27·5 μ, apice plerumque rotundatis rarius applanatis, medio leniter constrictis, basi plerumque rotundatis interdum attenuatis ; episporio 1·5 μ crasso, ad apicem haud incrassato ; pedicello hyalino, deciduo, teleutosporam subaequante, verticale v. oblique, nonnunquam transverse inserto.

Hab. in foliis *Sonchi* sp., Schagen, leg. Liebenberg, 26176.

Puccinia gnidiae nov. spec.

Uredosporis in soris teleutosporiferis immixtis, late ellipsoideis, ovatis v. subglobosis, brunneis, subtiliter denseque verruculosis, 25–30 × 22·5–25 μ ; episporio 2·5–3 μ crasso, poris germ. ca 4–7 sparsis praeditis.

Soris teleutosporiferis caulicolis v. amphigenis, sparsis v. aggregatis, rotundatis v. ellipticis, interdum confluentibus, ½–3 mm. longis, pulvinatis, epidermide lacerata cinctis. Teleutosporis sub-globosis, late ellipsoideis v. ovatis, levibus, castaneo-brunneis, 30–40 × 25–30 μ, apice late rotundatis interdum compressis, basi rotundatis v. subattenuatis, medio vix constrictis ; episporio 2·5–4 μ crasso, apice leniter (usque 8 μ) incrassato ; pedicello persistente, valido, interdum oblique inserto, hyalino v. subflavescente, 7·5–10 μ crasso, lumine haud raro fere nullo.

Hab. in caulis foliisque *Gnidiae macrocephalae* Meisn., Kaalfontein, leg. Pole Evans, 10083.

The stems of the host plant showed indications of the occurrence of an aecidium earlier in the season.

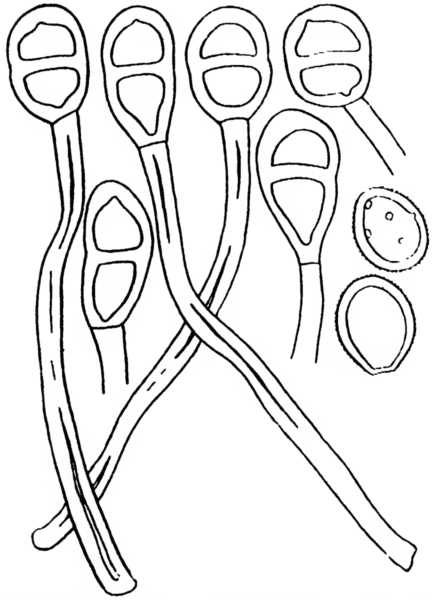


Fig. 4.—*Puccinia gnidiae*, teleutospores and uredospores.

Mesospores were occasionally seen; they were ovate, 30–33 × 25–27·5 μ, with characters similar to those of the teleutospores. The upper loculus of the teleutospore is often compressed, directly (making the apex almost flat) or obliquely.

Puccinia iridis (DC.) Wallr.

in Rabh. Krypt. Fl. ed. 1 (1844) 23; Syd. in Monogr. Ured. 1 (1904) 598.

Uredo-sori amphigenous, scattered or subgregarious, round, oblong or elongated, long covered by the epidermis, which at length splits and remains partially veiling the pulverulent sorus, up to 2 mm. long, rusty brown. Uredospores globose, subglobose, ellipsoid or ovate, ochraceous, 20–35 × 16–26 μ; epispore rather coarsely echinulate, 1·5–2 mm. thick, slightly thicker (2·5 μ) at the base, germ pores 2–3 equatorial, rather conspicuous, papillate.

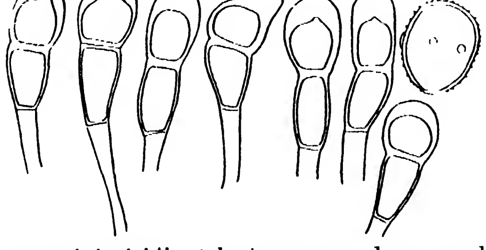


Fig. 5.—*Puccinia iridis*, teleutospores and one uredospore.

Teleuto-sori hypophyllous, scattered, sometimes confluent, sometimes developing between the uredo-sori, linear or striiform, early becoming naked, black. Teleutospores clavate or oblong, rounded, acuminate or truncate at the apex, slightly constricted at the septum, usually attenuate at the base, light golden brown, darker at the apex, 30–52 ×

14–22 μ; epispore smooth, delicate, about 1 μ thick in the lower loculus, up to 2 μ thick in the upper, very much thickened, up to 14 μ, at the apex; pedicel tinted brown, persistent, as long as the spore or shorter. The loculi separate readily at the septum.

Hab. on leaves of *Iris germanica* L., Johannesburg, *Hollis*, 25922, and *Iris* sp. (*regilio-cyclus*) Johannesburg *Hingst* 30142.

This rust, which is widely distributed in Europe and America, has only recently made its appearance in gardens in Johannesburg.

Puccinia caricis-cernuae nov. spec.

Soris uredosporiferis amphigenis, plerumque hypophyllis, sparsis v. gregariis, oblongis v. linearibus, usque 3 mm. longis, epidermide diu tectis, tandem longitudinaliter apertis, cinnamomeis; Uredosporis ovatis, ellipsoideis v. subglobosis, dilute brunneis, echinulatis, 20–25 × 16–19 μ. episporio 2–2·5 μ crasso, poris germ. obscuris.

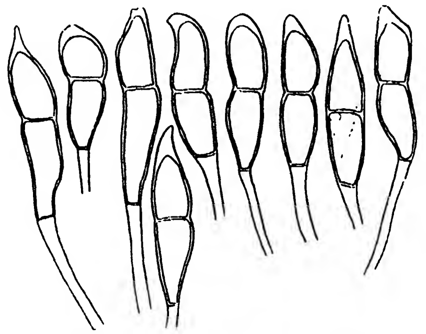


Fig. 6.—*Puccinia caricis-cernuae*, teleutospores.

Soris teleutosporiferis amphigenis, plerumque hypophyllis, maculis nullis v. indeterminatis flavis insidentibus, sparsis v. gregariis, oblongis v. linearibus, saepe in strias longas (usque 6 mm.) confluentibus, diu epidermide plumbea tectis, pulvinatis. Teleutosporis clavatis v. fusoideo-clavatis, apice rotundatis v. conico-angustatis, saepe oblique productis, nonnunquam subtruncatis, medio leniter constrictis, basi attenuatis, levibus, pallide brunneolis, sursum saturatioribus, 37·5–62·5 × 12·5–9 μ; episporio ca. 1 μ crasso, apice leniter (2·5–9 μ) incrassato; pedicello brunneolo, persistente, usque 48 μ longo, 4–5 μ crasso.

Hab. in foliis *Caricis cernuae* Boott. var. *austro-africanae* Kuk., Pelindaba, leg. Doidge et Bottomley, 29873; Skinner's Court, leg. Doidge et Bottomley, 23444.

Puccinia pegleriana nov. nom.

Syn. *Puccinia cyperi-tagetiformis* (P. Henn.) Kern var. *africana* Doidge in Bothalia 2 (1927) 116.

The South African fungus differs from *Puccinia cyperi-tagetiformis* (P. Henn.) Kern (Mycologia XI, 1919, p. 138) in several particulars; the uredospores are somewhat larger and have a much thicker wall, and the teleutospores are considerably longer. *P. cyperi-tagetiformis* is not represented in the Cryptogamic Herbarium at Pretoria and has not been compared with the South African material, but in view of the distinct differences in the descriptions of both uredo- and teleutospores, it is considered advisable to regard this as a distinct species and not as a variety.

Puccinia Morganae nov. spec.

Soris teleutosporiferis hypophyllis, maculis flavidis v. brunneolis effusis saepe insidentibus, minutis, rotundatis v. ellipticis, usque 0·4 mm. diam., sparsis v. irregulariter aggregatis, interdum confertis confluentibusque, pulvinatis, diutius tectis, demum epidermide rupta cinctis v. semivelatis, ochraceo-brunneis. Teleutosporis plerumque clavatis v. oblongo-clavatis, interdum fusiformis, rarissime 2-septatis, apice rotundatis, recte v. oblique conico-attenuatis, rarius truncatis, subhyalinis v. dilutissime flavo-brunneolis, 37·5–55 × 12·5–15 μ, rarius usque 17 μ latis ; episporio leve, tenue, usque 1 μ crasso, apice leniter (usque 3 μ) incrassato : pedicello subhyalino persistenti, usque 35 μ longo.

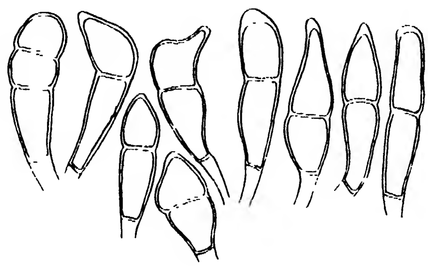


Fig. 7.—*Puccinia Morganae*, teleutospores.

Hab. in foliis *Cyperi albostriati* Schrad. in silvis Xumeni, prope Donnybrook, leg. Morgan et Doidge, 29985.

This species differs widely from *Puccinia cyperi-fastigiati* Doidge and *P. pegleriana* (Bothalia 2, 1928, p. 473 ; and 2, 1927, p. 117). Teleutospores of the former species are illustrated for comparison ; for form of the teleutospores of *P. pegleriana* see Bothalia, loc. cit.

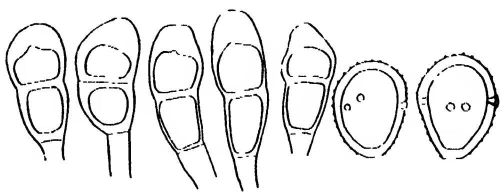


Fig. 8.—*Puccinia cyperi-fastigiati*, teleutospores and uredospores.

Puccinia fuirenella nov. spec.

Soris uredosporiferis sine maculis, plerumque hypophyllis, rarius epiphyllis, linearibus, minutis, usque 1 mm. longis, primo epidermide tectis, brunneis. Uredosporis late ellipsoideis, globosis v. ovatis, brunneis, 25–32·5 × 20–25 μ ; episporio 2–2·5 μ crasso, remotiuscule echinulato, poris germinationis 2 conspicuis papillatis equatorialibus praeditis.

Soris teleutosporiferis conformibus. Teleutosporis longe clavatis v. lanceolatis, levibus, diluto aureo-brunneis, apice plerumque pallidioribus, rotundatis truncatis v. conicis, nonnunquam obliquis, rarissime dentibus 2 coronatis, medio leniter constrictis, deorsum in pedicellum attenuatis. 42–72·5 × 17·5–22·5 μ ; episporio 1–2·5 μ crasso, ad apicem valde incrassato usque 13 μ ; pedicello subhyalino, usque 40 μ longo, apice 8–10 μ crasso, deorsum attenuatis.

Hab. in foliis vaginisque *Fuirenae pubescentis* (Lam.) Kunth., Donkerpoort, leg. Doidge et Bottomley, 29977.

The uredo-form also occurs on :—

Fuirena coerulescens Steud., Maritzburg, *Pole Evans*, 1444.

Fuirena pubescens (Lam.) Kunth, Nelspruit, *Liebenberg*, 26074.

Fuirena chlorocarpa Ridley, Xumeni Forest, Donnybrook, *Morgan* and *Doidge*, 29823 ; Donkerpoort, *Doidge* and *Bottomley*, 29983.

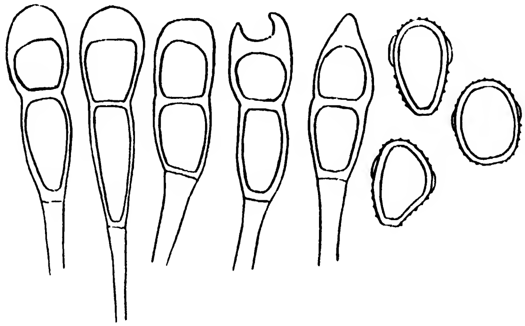


Fig. 9.—*Puccinia fuirenella*, teleutospores and uredospores.

The uredo on *F. coerulescens* was recorded under the name *Uredo Fuirenae* P. Henn. in Bothalia 2 (1927), p. 198. *Uredo Fuirenae* P. Henn. was originally described on *Fuirena umbellata* from Brazil, and has been shown by Kern, Ciferri and Thurston in Ann. Myc. 31 (1933), p. 13, to be the uredo-form of *Puccinia fuirenicola* Arth. A portion of the type collection (Mycoflora Domingensis exsiccata 117) of this rust has been examined; the uredospores resemble those of *Puccinia fuirenella*, but the teleutospores differ in several particulars from those of the South African rust. The original description reads " teliospores cylindric or ellipsoid, constricted at septum, rounded or somewhat pointed above and usually narrowed below ; wall cinnamon brown, 1·5–2 μ ; upper cell usually darker and thickened at the apex, 4–7 μ ; pedicel slightly tinted, the length of the spore or less ".

Puccinia fuirenella also differs from *P. Fuirenae* Cke. [Grevillea 6, p. 137 ; Syd. Monogr. Ured. 1 (1904) 687] : the teleutospores of the latter species are more slender, 11–15 μ broad, and the uredo-spores have 3–4 germ pores.

Puccinia kyllingicola nov. spec.

Soris uredosporiferis amphigenis v. calamicolis, plerumque autem hypophyllis, maculis conspicuis rufo-brunneis insidentibus, sparsis v. paucis aggregatis, nonnumquam circulariter circa sorum centralem dispositis, ellipticis v. oblongis, ½ to 1 mm. longis, epidermide inflata diu tectis. Uredosporis ovatis, ellipsoideis, subglobosis, subinde angulatis, diu hyalinis v. subhyalinis, tandem flavis v. flavo-brunneolis, 22–32·5 × 15–20 μ ; episporio 1·5–2 μ crasso, breviter laxiusculeque echinulato, poris germ. 2, rarius 3–4, equatorialibus praedito.

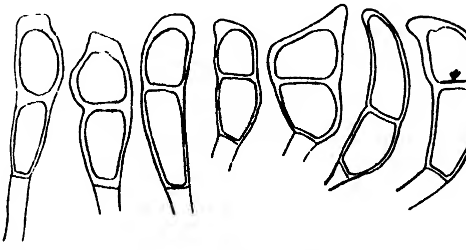


Fig. 10.—*Puccinia kyllingicola*, teleutospores.

Soris teleutosporiferis minutis, compactis, epidermide tectis. Teleutosporis oblongis v. clavatis, rectis v. curvatis, levibus, aureo-brunneis, apice rotundatis, truncatis v. attenuatis, interdum obliquis, medio leniter constrictis, basi saepius attenuatis, 40–77 × 15–25 μ plerumque 15–20 μ latis ; episporio ca. 1·5 μ crasso apice incrassato usque 10 μ ; pedicello subpersistente, brunneolo, usque 25 μ longo.

Hab. in foliis calamisque *Kyllingae melanospermae* Nees, Donkerpoort, leg. Doidge et Bottomley, 29971 ; II. Karino, leg. Wager, 23414.

This rust differs from *Puccinia mysorensis* Syd. et Butler [Ann. Myc. 4 (1906), p. 434], in the size of the teleutospores, which are larger and thicker at the apex. The uredo resembles *Uredo Kyllingiae* P. Henn., but so far as can be ascertained the teleuto-stage of this American species has not been described.

Puccinia schoenoxyphii nov. spec.

Soris teleutosporiferis sparsis, maculis minutis, brunneis, conspicuis, plerumque ellipticis, usque 2 mm. longis, singulariter insidentibus ; soris minutis, ellipticis, ½ to ¾ mm longis, fusco-brunneis, diu epidermide bullata tectis. Teleutosporis plerumque clavatis, rarius fusoideis v. oblongis, rectis v. leniter curvatis, pallide luteo-auranteis, ad apicem obscurioribus, apice rotundatis rarius recte v. oblique obtuse conicis, medio plus minus contrictis, basi plerumque attenuatis, nonnunquam subrotundatis, 40–58 × 14–20 μ ; episporio leve, tenue, 1–1·5 μ crasso, ad apicem valde incrassato, 7·5–12·5 μ, interdum usque 15·5 μ ; pedicello persistente, leniter brunneolo, 5 μ crasso et usque 50 μ longo.

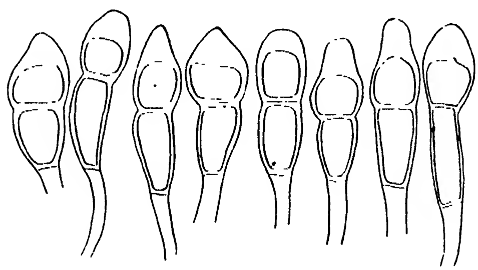


Fig. 11.—*Puccinia schoenoxyphii*, teleutospores.

Hab. in foliis *Schoenoxyphii spartii* Kuk., in silvis Xumeni, prope Donnybrook, leg. Morgan et Doidge, 30106.

Puccinia scleriae-dregeanae nov. spec.

Soris uredosporiferis amphigenis, plerumque hypophyllis, maculis minutis, conspicuis, elongatis, usque 1 mm. longis, sparsis insidentibus, singulis v. paucis in quoque macula, ellipticis v. linearibus, cinnamomeis, usque 400 μ longis, diu epidermide bullata tectis. Uredosporis ellipsoideis, ovatis v. subglobosis, 20–30 × 15–20 μ ; episporio fere hyalino, 1–1·5 μ crasso, remote subtiliterque echinulato, poris germ. obscuris, ut videtur 3, equatorialibus.

Soris teleutosporiferis inter soros uredosporiferos sparsis, hypophyllis, minutis, 150–200 μ longis, ellipticis, atro-brunneis, epidermide tectis, compactis. Teleutosporis plerumque clavatis, rarius cylindraceis v. fusoideis, 30–45 × 10–22·5 μ, cellula superiore pallide auranteo-brunnea usque cinnamomea, inferiore pallidiore, apice rotundatis, truncatis v. plerumque oblique acuminatis v. melius in rostrum productis, medio non vel vix constrictis, basi plerumque pedicellum versus attenuatis, interdum subrotundatis ; episporio leve, tenue, 1–1·5 μ crasso, ad apicem leniter incrassato 3·5–8 μ ; pedicello persistente, pallide flavo-brunneolo, 5–6 μ crasso et usque 23 μ longo.

Hab. in foliis *Scleriae Dregeanae* Kunth, Donkerpoort, leg. Doidge et Bottomley, 29982.

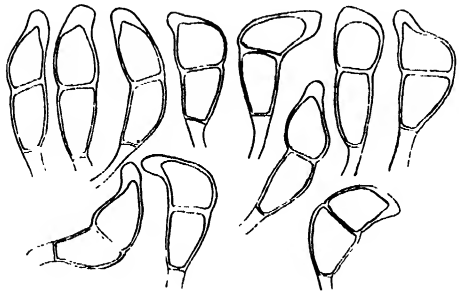


Fig. 12.—*Puccinia scleriae-dregeanae*, teleutospores.

The loculi separate readily at the septum and fall apart. This rust differs widely from *Rostrupia scleriae* Pazschke in the size of the teleutospores and sori, and in the absence of 2-septate spores. It approaches more nearly to *Puccinia scleriicola* Arthur, but there has been no opportunity of examining this species. The description differs in several details (Mycologia 7, 1915, p. 232) particularly in the almost hyaline uredospores.

Puccinia amphilophidis nov. spec.

Soris uredosporiferis hypophyllis, maculis brunneolis indeterminatis insidentibus, minutis, usque $\frac{3}{4}$ mm. longis, oblongis, sparsis v. gregariis, mox nudis, epidermide lacerata cinctis, cinnamomeis. Uredosporis plerumque ovatis, rarius ellipsoideis v. subglobosis, echinulatis, brunneis, 25–35 × 17·5–20 μ; episporio 1·5–2·5 μ crasso, ad apicem nonnunquam leniter incrassato usque 4 μ, poris germinationis 4–6 equatorialibus praedito. Paraphysibus numerosis, capitatis v. clavatis, flavo-brunneolis, rarius hyalinis, rectis v. leniter curvatis, 45–85 μ longis, ad apicem 12·5–20 μ latis, membrana ca 2–2·5 crassa, ad apicem usque 7·5 μ incrassata, lumine haud raro fere nullo.

Soris teleutosporiferis consimilis, atro-brunneis. Teleutosporis subglobosis v. oblongo-ellipsoideis, levibus, castaneo-brunneis, 30–40 × 22–25 μ, apice late rotundatis, basi rotundatis v. subattenuatis, medio vix constrictis; episporio 2·5–3 μ crasso, apice leniter incrassato, usque 6·5 μ; pedicello persistente, crassiusculo, apice 5–7·5 μ crasso, usque 115 μ longo, ubique brunneolo, interdum oblique, rarius lateraliter inserto.

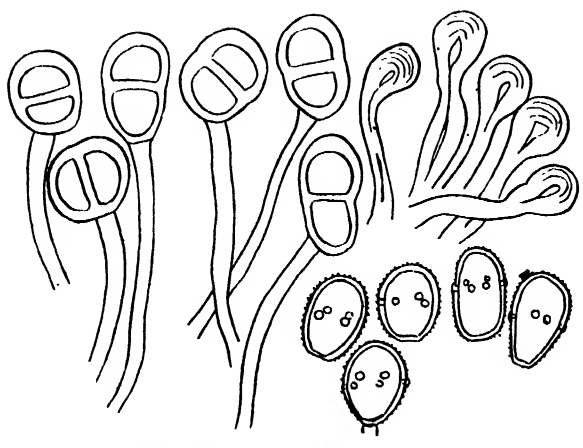


Fig. 13.—*Puccinia amphilophidis*, teleutospores, paraphyses and uredospores.

Hab. in foliis *Amphilophidis insculptae* Stapf., Schagen, leg. Liebenberg, 26024; II. Godwan River. leg. Liebenberg, 26056; Nelspruit leg. Liebenberg, 26029; Warmbaths, leg. Curson, 26394.

This rust resembles *Puccinia versicolor* and *P. erythraeënsis*, which also occur on Andropogoneae, in the form of its teleutospores, but differs in having brown pedicels. The uredospores differ from those of either of the two species mentioned in having 4–6, fairly conspicuous, sub-papillate, equatorial germ pores.

Puccinia eucomis nov. spec.

Soris uredosporiferis amphigenis, dense seriatim dispositis, oblongis, ½–1 mm. longis saepe autem confluendo longioribus, aurantiacis, mox nudis, pulverulentis, epidermide fissa cinctis. Uredosporis plerumque ovatis, rarius subglobosis v. oblongis, 25–35 μ × 18–22·5 μ; episporio subhyalino, subtiliter verruculoso, 2–2·5 μ crasso, ad apicem incrassato 6–7·5 μ, rarius usque 9 μ; poris germinationis obscuris; paraphysibus nullis.

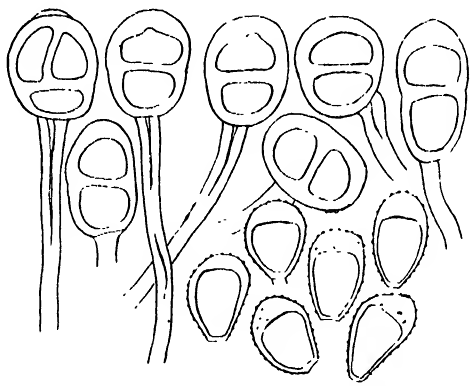


Fig. 14.—*Puccinia eucomis*, teleutospores and uredospores.

Soris teleutosporiferis conformibus, atro-brunneis, subpulvinatis. Teleutosporis castaneis, levibus, plerumque late ellipsoideis, rarius subglobosis v. ovatis, apice late rotundatis, medio haud constrictis, basi rotundatis v. interdum sub-attenuatis, 35–47·5 × 22·5–30 μ; episporio 2·5–3 μ crasso, apice incrassato usque 9 μ, plerumque ca 7·5 μ pedicello crasso, persistente, pallide brunneolo, saepe oblique v. transverse inserto, 7·5–8 μ crasso et usque 100 μ longo.

Hab. in foliis vaginisque *Andropogonis eucomis* Nees, Donkerpoort, leg. Doidge et Bottomley, 30129.

The uredo has also been collected on *Andropogon huillensis* Rendl. Donkerpoort, *Doidge* and *Bottomley*, 30132.

One 3-celled teleutospore was seen. The contents of the uredospores are bright orange, and this gives the orange colour to the uredo-sori.

The teleutospores of the known species of *Puccinia* on South African Andropogoneae resemble one another very closely; the uredoform is more distinctive, and the species of rust on these hosts may readily be distinguished when uredo-spores are present. The distinguishing characters are indicated in the following key:—

A. Paraphyses present, germ pores conspicuous.

a. Uredo-spore uniformly thin walled, brown, with 5–8, rather conspicuous, scattered germ pores.... *Puccinia erythraeënsis*.

b. Wall of uredo-spore thickened at the apex.

x. Apex slightly thickened, up to 4 μ, spore 25–35 × 17·5–20 μ, 4–6, equatorial germ pores.................................. *Puccinia amphilophidis.*

xx. Apex more definitely thickened, up to 8 μ, spore 30–42·5 × 22·5–30 μ, 2–3 equatorial germ pores.......................... *Uredo schizachyrii.*

B. Paraphyses wanting.

a. Germ pores obscure.

x. Wall of uredo-spore thickened irregularly, cavity stellate.......................... *Puccinia versicolor.*

xx. Wall thickened at the apex, up to 9 μ.... *Puccinia eucomis.*

b. Germ pores evident, 4–7, scattered.............. *Uromyces Clignyi.*

Puccinia Bottomleyae nov. spec.

Soris uredosporiferis amphigenis, plerumque epiphyllis, oblongis, cinnamomeis, ½–⅝ mm. longis, mox nudis, epidermide fissa cinctis, pulverulentis. Uredosporis saepe etiam teleutosporis immixtis, sub-globosis, ovatis v. ellipsoideis, brunneis, 22–30 × 20–25 μ, laxe minuteque aculeatis; episporio 1·5–2 μ crasso, poris germinationis 4–7, sparsis instructis.

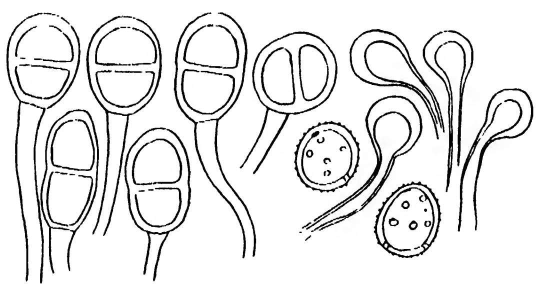


Fig. 15.—*Puccinia Bottomleyae*, teleutospores, uredospores and paraphyses.

Soris teleutosporiferis conformibus, atro-brunneis. Teleutosporis subglobosis, oblongis v. ovatis, castaneo-brunneis, levibus, apice rotundatis, medio haud constrictis, basi rotundatis v. subattenuatis, 27·5–40 × 20–25 μ; episporio 2–2·5 μ crasso, apice leniter incrassato, usque 6 μ; pedicello persistente, apice brunneolo, 6–6·5 μ crasso, 85–112·5 μ longo, nonnumquam oblique inserto. Mesosporis paucis, subglobosis v. ovatis, 25–27·5 × 22·5 μ. Paraphysibus numerosis, capitatis, brunneolis, 50–100 μ longis; capite 15–20 μ latis, membrana leve, 1–1·5 μ crassa, apice valde incrassata, usque 10 μ.

Hab. in foliis *Aristidae Welwitschiae* Rendl. et *A. barbicollis* Trin. et Rupr., Derdepoort, leg. Doidge et Bottomley, 29793 et 29795.

Aristida adscensionis Linn., Buffelspoort, Marikana, leg. Doidge, 29991; Derdepoort, leg. Doidge et Bottomley, 29790.

Aristida sp., Derdepoort, leg. Doidge et Bottomley, 29789.

Puccinia digitariae Pole Evans.

in Ann. Bolus Herb. 2 (1917), 111; Doidge in Bothalia 2 (1927), 124.

Syn. *Uredo digitariaecola* Thuem. in Myc. Univ. No. 2041 (1882); Syd. Monogr. Ured. 4 (1924), 604.

The illustration of this rust in Bothalia (loc. cit.) is misleading. The teleutospores are closely crowded in the minute, compact sori and are consequently much more irregular in form than the drawing indicates, especially at the apex. One 3-celled spore was seen, and in several teleutospores, germ pores at the apex and just below the septum were observed. The teleutospores are delicate and very easily crushed.

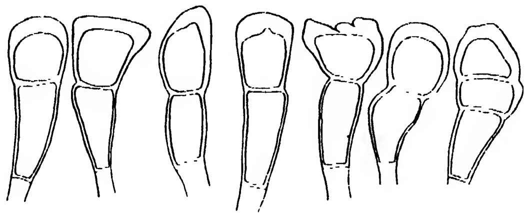


Fig. 16.—*Puccinia digitariae*, teleutospores.

In addition to the hosts previously recorded, i.e. *Digitaria debilis*, *D. eriantha* and *D. Smutsii*, this rust has been found on :—

Digitaria horizontalis Willd., Nelspruit, *Liebenberg*, 26649.

Digitaria Pentzii Stent, Donkerpoort, *Doidge* and *Bottomley*, 29750, Ashbury, *Doidge* and *Bottomley*, 29783.

Digitaria setivalva Stent, Salisbury, *Hopkins*, Rhod. Myc. Herb., 2002 and 2071.

The Rhodesian collection [Hopkins in Trans. Rhod. Sc. Ass. 35 (1938), 106], is designated "*Puccinia digitariae* affinis". From an examination of a portion of this material kindly supplied by Dr. Hopkins, it appears that this rust is typical *Puccinia digitariae*.

Puccinia eragrostidis-chalcanthae nov. spec.

Soris teleutosporiferis epiphyllis, oblongis, 0·5–2·5 mm. longis, sparsis v. aggregatis et confluendo longioribus, mox nudis, brunneis, pulverulentis. Teleutosporis subglobosis v. oblongis, aureo-brunneis, 26–27·5 × 17·5-25 μ, apice late rotundatis v. obtuse conicis, medio haud constrictis, basi rotundatis; episporio leve, 3–4 μ crasso, apice plerumque incrassato, usque 8 μ; pedicello tenue, hyalino, persistente, usque 75 μ longo, ad apicem 5 μ crasso, deorsum attenuato.

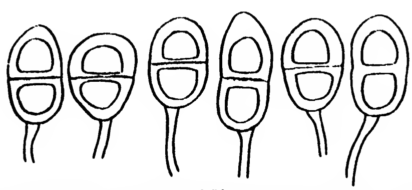


Fig. 17.—*Puccinia eragrostidis-chalcanthae*, teleutospores.

Hab. in foliis *Eragrostidis chalcanthae* Trin., Donkerpoort, leg, Doidge et Bottomley, 29760.

Through the courtesy of Dr. Kern and of Dr. Stevenson of the Division of Mycology and Plant Disease Survey, Washington, a portion of the type collection of *Puccinia eragrostidicola* Kern, Thurston and Whetzel (Mycologia 25, 1933, p. 469) was available for study. The South African rust described above is near this species, but the teleutospores

are much more variable in form and are thicker walled; the pedicel is hyaline and inserted directly, whereas in *P. eragrostidicola* it is tinted brown and is often oblique. *Puccinia eragrostidis* Petch (Ann. Roy. Bot. Gard. Peradeniya 6, 1917, pp. 209, 216) has narrower, ovoid or oblong-ovoid teleutospores, 20–32 × 15–17 μ, with hyaline, oblique pedicel.

Puccinia eragrostidis-superbae nov. spec.

Soris uredosporiferis amphigenis, plerumque hypophyllis, ochraceis, ellipticis v. oblongis, minutis, usque ½ mm. longis, epidermide fissa cinctis. Uredosporis ovatis, fusco-brunneis, ad apicem obscurioribus, 27–32 × 17–25 μ; episporio 1·5–2 μ crasso, ad apicem saepe leniter incrassato, usque 4 μ, sparse valideque echinulato, poris germinationis 4–6, conspicuis, equatorialibus praedito. Paraphysibus satis numerosis, clavatis, rectis v. leniter curvatis, 25–65 × 8–17·5 μ; membrana leve, 1·5–4 μ crasso, ad apicem incrassato usque 12·5 μ.

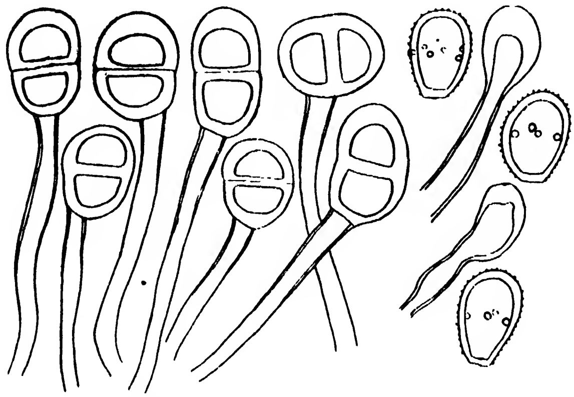


Fig. 18.—*Puccinia eragrostidis-superbae*, teleutospores, paraphyses and uredospores.

Soris teleutosporiferis amphigenis, plerumque hypophyllis, atro-brunneis, oblongis, ½–1 mm. longis, saepe confluendo longioribus, epidermide fissa cinctis. Teleutosporis subglobosis, ovatis v. late ellipsoideis, utrinque rotundatis, medio non vel vix constrictis, 35–45 × 25–30 μ; episporio leve, castaneo-brunneo, cellula inferiore 3–4 μ crasso, cellula superiore 4–5 μ crasso, ad apicem incrassato 8–10 μ; pedicello persistente crasso, ad apicem 8–10 μ crasso, brunneolo, usque 112 μ longo, membrana crassa.

Hab. in foliis *Eragrostidis superbae* Peyr., Derdepoort, leg, Doidge et Bottomley, 29811; (II) in foliis *Eragrostidis happulae* Nees var. *divaricatae* Stapf. Derdepoort, leg. Doidge et Bottomley, 29813.

Puccinia miscanthidii nov. spec.

Soris uredosporiferis hypophyllis, minutis, sparsis, ca. ½ mm. longis, pulverulentis, luteo-aurantaceis v. cinnamomeis. Uredosporis ovatis, oblongis v. subglobosis, pallide aurantiacis deinde brunneis, 24–30 × 17·5–25 μ; episporio 1–1·5 μ crasso, subtiliter verruculoso, poris germinationis obscuris, ut videtur minutis sparsis.

Soris teleutosporiferis amphigenis, plerumque hypophyllis, sparsis, aggregatis v. seriatim dispositis, ¼–2 mm. longis, saepe confluendo longioribus, pulvinatis, atro-brunneis, epidermide fissa cinctis. Teleutosporis castaneo-brunneis, apice saepe obscurioribus, oblongis, clavatis, subglobosis v. irregularibus, apice rotundatis v. conicis, rarius truncatis, medio non vel vix constrictis, basi rotundatis v. subattenuatis, 30–50 × 20–30 μ; episporio leve, 2–2·5 μ crasso, apice incrassato usque 8 μ; pedicello crassiusculo, persistente, ubique brunneolo, ca 10 μ crasso, usque 87·5 μ longo, saepe oblique, interdum lateraliter inserto.

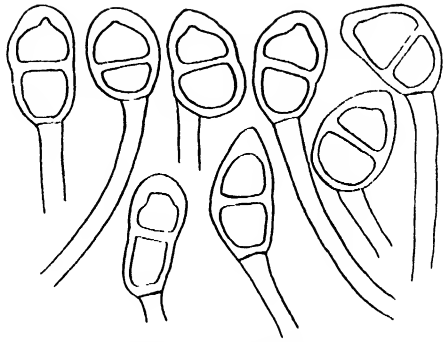


Fig. 19.—*Puccinia miscanthidii*, teleutospores.

Hab. in foliis *Miscanthidii sorghi* Rich., Lundie's Hill, Umkomaas Valley, leg, Doidge 30104; in foliis *Miscanthidii juncei* Stapf., Trigaartspoort, leg. Doidge et Bottomley, 30105.

This species is closely related to *Puccinia imperatae* Doidge on *Imperata cylindrica* Beauv. (Bothalia 2, 1928, p. 474) from which it differs in the colour and form of the teleutospores; they are darker brown, more irregular in form and thinner walled; the pedicel is tinted brown throughout, and is frequently inserted obliquely, occasionally transversely.

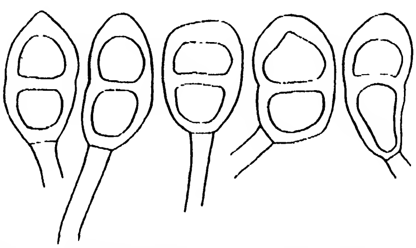


Fig. 20.—*Puccinia imperatae*, teleutospores.

Puccinia pogonarthriae Hopkins.

in Trans. Rhod. Sc. Soc. 35 (1938), 106.

Syn. *Uredo pogonarthriae* Syd. in Ann. Myc. 10 (1912), 35; in Bothalia 2 (1927), 198.

Uredo-sori amphigenous, but mostly hypophyllous, scattered, oblong, ½-2 mm. long, surrounded by the torn epidermis, pulverulent, rusty brown. Uredospores globose or subglobose, light brown, 22–26 × 18–22 μ; epispore light golden brown, 1·5–2·5 μ thick, delicately echinulate and with about six scattered germ pores.

Teleutosori epiphyllous, scattered, oblong, ½–2 mm. long, dark brown, surrounded by the torn epidermis, soon becoming pulverulent. Teleutospores subglobose or oblong, broadly rounded or obtusely conical at the apex, not constricted at the septum or very slightly so, rounded at the base, golden brown, 25–40 × 17–25 μ; epispore smooth, 2·5–4·5 μ thick, often slightly thickened, up to 8 μ, at the apex; germ pore apical or slightly oblique in the upper cell, one-half to one-third of the distance from septum to base in the lower cell; pedicel sub-persistent, hyaline, 5 μ thick at the apex, and up 50 μ long.

Hab. on leaves of *Pogonarthria squarrosa* (Light.) Pilg., Donkerpoort, *Doidge* and *Bottomley*, 29757.

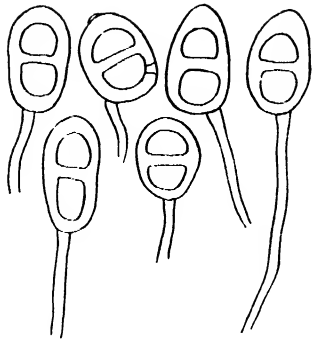


Fig. 21.—*Puccinia pogonarthriae*, teleutospores.

A portion of the type collection was made available for comparison through the courtesy of Dr. Hopkins. The type was collected on the same host at Marandellas (Rhod. Govt. Myc. Herb., 2163); it is evidently the same species as the rust collected at Donkerpoort but the teleutospores of the latter are more variable in form. The description is amended accordingly. The uredo described by Sydow (loc. cit.) on *Pogonarthria squarrosa*, was found on the same leaves.

Puccinia luxuriosa Syd.

in Monogr. Ured. 1 (1904), 812.

Syn. *Puccinia tosta* var. *luxuriosa* Arth. in Bull. Torr. Bot. Club 29 (1902), 229.

Teleuto-sori amphigenous, scattered or in groups, oblong or linear, often confluent and forming striae up to 6 mm. long, rather compact, black. Uredospores mixed with the teleutospores, globose or subglobose, verrucoso-echinulate, yellow brown, 22–30 μ diam.; epispore about 2 μ thick, with six or more scattered germ pores.

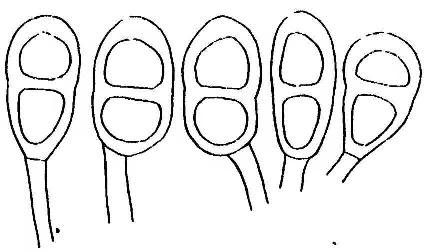


Fig. 22.—*Puccinia luxuriosa*, teleutospores.

Teleutospores ellipsoid or oblong, rounded at the apex, usually slightly constricted at the septum, usually rounded at the base, brown, 36–56 × 20–28 μ; epispore smooth, 3–5 μ thick, thickened at the apex, up to 10 μ; pedicel stout, persistent, brown at the apex and 7–8 μ thick, up to 110 μ long.

Hab. on leaves of *Sporobolus pectinatus* Hack., Donkerpoort, *Doidge* and *Bottomley*, 29726.

On *Sporobolus capensis* (Willd.) Kunth, Donkerpoort, *Doidge* and *Bottomley*, 29758.

This rust was originally described on *Sporobolus aeroides* in Oregon and Montana, North America; the South African rust agrees well with the description of the American fungus.

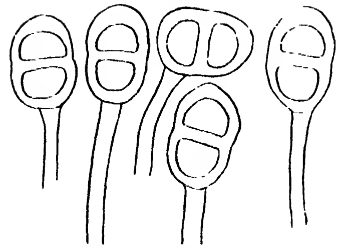


Fig. 23.—*Puccinia tosta*, teleutospores.

Puccinia luxuriosa differs from *P. tosta* Arthur previously recorded on *Sporobolus fimbriatus* Nees (Bothalia 2, 1928, p. 474) in the larger and much more conspicuous sori, the echinulate uredospores, and the definitely larger teleutospores. The teleutospores of both species are illustrated for comparison.

Puccinia tristachyae Doidge
in Bothalia 2 (1927), 132.

The type specimen of this rust was collected at Kaalfontein on *Tristachya Rehmanni* Hack., and the teleutospores were described as follows: "Teleutospores clavate, ellipsoid or oblong, upper cell usually shorter than the lower, rounded or truncate at the apex, rarely subacute, more or less constricted at the septum, attenuate or rounded at the base, golden brown, 40-60 × 16-23 μ; epispore smooth, 1·5-2 μ thick in the lower cell, 2·5-3 μ thick in the upper, rarely very slightly thickened, up to 4 μ, at the apex; pedicel persistent, rather stout, light brown, up to 45 μ long and 6·5 μ thick." The first four spores in the figure are typical of those found in the type collection. (See also Bothalia loc. cit.)

Rust pustules on a recent collection of *Tristachya hispida* K. Schum. are apparently those of the same fungus, but the teleutospores are much more variable than those of the type specimen. A large proportion are typical in form, but comparatively few are 45–55 μ long; the majority are smaller. A large number are irregular in shape, as if through compression; the pedicel is often inserted obliquely and rarely transversely. Mesospores are fairly numerous.

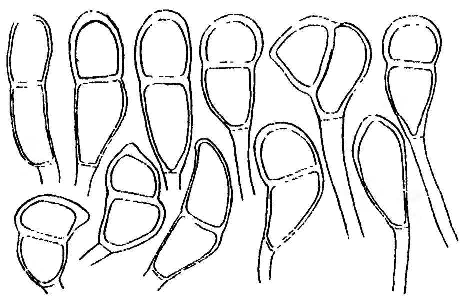


Fig. 24.—*Puccinia tristachyae*, teleutospores.

There is no doubt that the rust on *Tristachya hispida* is a more variable form of *Puccinia tristachyae,* and the description must be amended to include the smaller and more irregular teleutospores found in this collection. It will then read: Teleutospores clavate, ellipsoid, oblong or irregular; upper cell shorter than the lower, or cells sub-equal; apex rounded, truncate or bluntly conical, in the latter case often oblique; more or less constricted at the septum, attenuate or rounded at the base, 30–60 × 15–30 μ; a large proportion of the spores do not exceed 40 μ in length; pedicel as previously described, but occasionally oblique and rarely transverse. Mesospores fairly numerous, clavate or cylindrical, 30–53 × 13–17·5 μ.

Hab. on leaves *Tristachya hispida* K. Schum., Donkerpoort, *Doidge* and *Bottomley,* 30133.

Ravenelia Evansii Syd.

in Ann. Myc. 10 (1912), 440; Monogr. Ured. 3 (1915), 234; Doidge in Bothalia 2 (1927), 144.

Uredo-sori amphigenous, mostly hypophyllous, also on the petioles, subepidermal, minute, round, scattered or in small groups (usually 2–3), 0·1–0·25 mm. diam., surrounded by the torn epidermis, sub-pulverulent, cinnamon brown, on the same leaflets as the teleuto-sori. (Teleuto-sori are sometimes found on the under side of the leaf, they are not exclusively epiphyllous as the original description might seem to indicate.) Uredospores ellipsoid or ovate, pale yellowish brown, 20–30 × 12·5–15 μ, the length being much more variable than the breadth; epispore 1·5–2 μ thick, occasionally thickened at the apex, up to 5 μ, rather closely verruculose-echinulate and with 4 equatorial germ pores. Paraphyses numerous, capitate, yellowish or light brown at the apex, hyaline below, 37·5–50 μ long, 12·5–17·5 μ broad.

Hab. on leaves of *Acacia robusta* Burch., Umzinto, Natal, *McClean*, 30124.
On *Acacia Gerrardi* Benth., Verulam, Natal, *Halse*, 30127.

The type specimen described by Sydow (loc. cit.) showed only the teleuto-sori; the aecidium was subsequently described in Bothalia. A recent collection from the Natal coast has numerous uredo-sori and a few teleuto-sori on the leaves. Uredo- and teleuto-sori were also found on *Acacia Gerrardi*, which is a new host for this rust.

Ravenelia Halsei nov. spec.

Soris teleutosporiferis amphigenis et petiolicolis, plerumque hypophyllis, sparsis, minutis, rotundatis v. ellipticis, 120–300 μ long, cuticula rupta cinctis, obscure brunneis, Capitulis teleutosporarum leniter convexis, ambitu orbicularibus v. suborbicularibus, subtus leniter concavis, castaneo-brunneis, levis, 80–112 μ diam., ex 9–11 sporis in omni

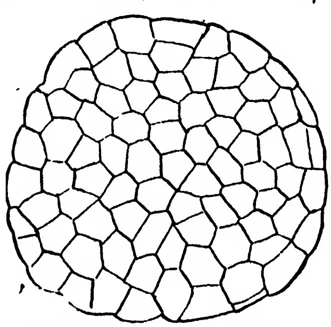


Fig. 25.—*Ravenelia Halsei*, teleutospore heads.

directione compositis; sporis singulis continuis, recte v. oblique cuneatis vel oblongis, 25–30 μ longis, 10–15 μ latis, ad apicem incrassatis (5–6 μ); cystidiis eodem numero quo sporis marginalibus, capitulis dense adpressis, in aqua intumescentibus et tandem ruptis; pedicello brevi deciduo ex hyphis paucis composito, hyalino.

Hab. in foliis petiolisque *Acaciae ataxacanthae* DC., Ndwedwe, Natal, leg. Halse, 30117.

Ravenelia modesta nov. spec.

Soris teleutosporiferis subepidermicis, amphigenis v. petiolicolis, plerumque hypophyllis, sparsis, minutis, brunneis, 250–300 μ diam., Capitulis teleutosporarum convexis, subtus leniter concavis, ambitu orbicularibus, suborbicularibus v. irregularibus, 75–105 μ diam., aureo-brunneis, ex sporis 5–6 in omini directione compositis; sporis omnibus papillis 4–7 (plerumque 5) subhyalinis v. brunneolis, 3–5 μ longis obsitis; sporis singulis continuis, cuneatis, 27·5–45 μ longis, 13–18 μ latis, ad apicem incrassatis; cystidiis eodem numero quo sporis marginalibus, in aqua intumescentibus; pedicello composito brevi, hyalino.

Hab. in foliis *Acaciae stoloniferae* Burch., Pienaar's River, leg. *Doidge et Bottomley*, 30110.

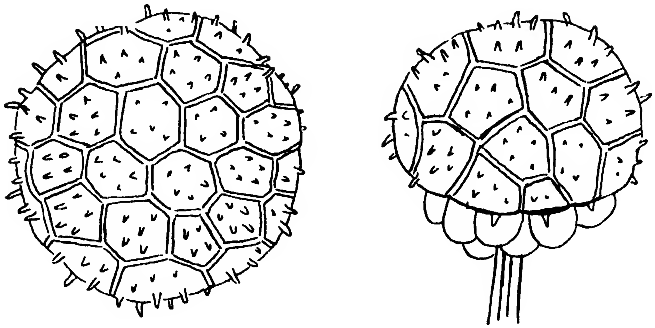


Fig. 26.—*Ravenelia modesta*, teleutospore heads.

This species is near *Ravenelia pretoriensis* Syd., but it differs in several particulars. The heads are more definitely convex; the papillae are longer and more conspicuous, acuminate rather than verruciform, straight, oblique or somewhat curved. The sori are very minute; there is frequently only one and rarely more than 2 or 3 on a single leaflet.

Ravenelia pretoriensis Syd.

in Ann. Myc. 10 (1912), 441; Doidge in Bothalia 2 (1927), 146.

The host of this rust has been wrongly identified; it is definitely not *Acacia horrida* Willd. (= *Acacia karroo*). The branch and leaf characters agree well with those of *Acacia pennata* Willd. and it may be this species; an exact identification is not possible without the pods, which are absent from the material. Further collections will therefore be necessary before the identity of the host can be determined satisfactorily.

In Bothalia (loc. cit.) the drawing of *Ravenalia pretoriensis*, p. 147, is erroneously labelled *R. Pienaarii*, and under that of *R. Pienaarii* (p. 146) the legend reads *R. pretoriensis*.

Ravenelia transvaalensis nov. spec.

Soris teleutosporiferis amphigenis et petiolicolis; epiphyllis conspicuis, sparsis v. paucis aggregatis, atro-brunneis, rotundatis v. irregularibus, usque 2 mm. diam., epidermide lacerata cinctis; hypophyllis petiolisque inconspicuis, effusis, indeterminatis. Capitulis teleutosporarum convexis, subtus leniter concavis, ambitu orbicularibus, suborbicularibus v. irregularibus, castaneo-brunneis, levibus, 75–100 μ diam., ex sporis 5–6 in omni directione composito; sporis singulis 30–35 μ longis, 15–17·5 μ latis, ad apicem incrassatis (ca 6 μ); cystidiis numerosis, ut videtur eodem numero quo sporis singulis, ovatis, dependentibus, in aqua intumescentibus; pedicello non viso.

Hab. in foliis *Acaciae detinentis* Burch., prope Pienaar's River, leg. Mogg, 27382.

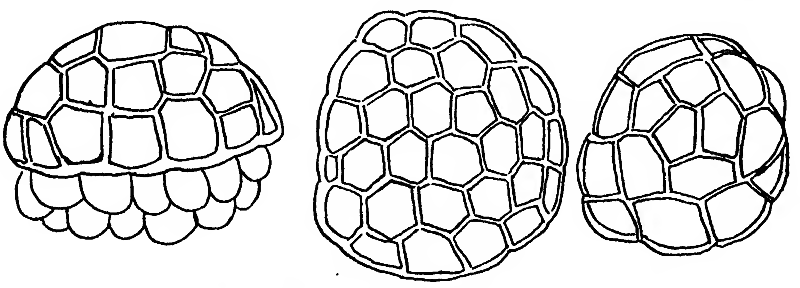


Fig. 27.—*Ravenelia transvaalensis*, teleutospore heads.

Uredo Hyperici-leucoptychoides nov. spec.

Soris hypophyllis, maculis flavis insidentibus, sparsis v. aggregatis, minutissimis, usque 0·2 mm. diam., aurantiacis, mox nudis, ab cellulis epidermidis peridiiformiter cinctis. Paraphysibus numerosissimis, periphicis, clavatis v. clavato-capitatis, saepe irregularibus, 50–100 μ longis, uncinatis, geniculato-incurvatis v. rectis, hyalinis, ad apicem 10–15 μ crassis, membrana 2–4·5 μ crassa, superne plus minusve incrassata (usque 6·5 μ) lumine

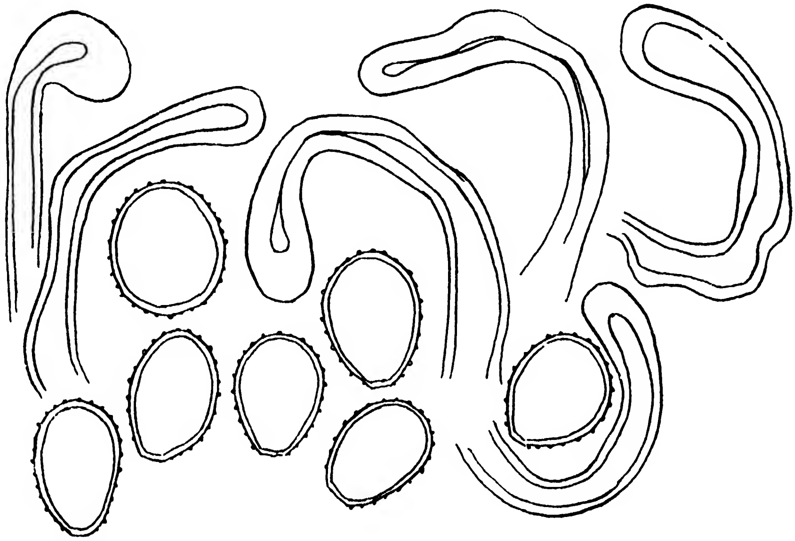


Fig. 28.—*Uredo hyperici-leucoptychoides*, spores and paraphyses.

haud raro fere nullo. Sporis subglobosis, ovatis v. ellipsoideis, pallide flavo-brunneolis, 17–25 x 15–20 μ, subtiliter laxeque echinulatis, episporio ca 1 μ crasso, poris germinationis haud conspicuis (? 4–7 sparsis).

Hab. in foliis *Hyperici leucoptychodis* Steud., Woodbush, leg Doidge, 28467.

This rust closely resembles *Uredo Hyperici-mysorensis* Petch, which occurs in Ceylon, but the paraphyses are longer and stouter. It differs widely from *Uredo Hyperici-Schimperi* P. Henn. described on *Hypericum Schimperi* from Central Africa.

Uredo combreticola nov. spec.

Soris amphigenis, sine maculis, per totam folii superficiem plus minus dense sparsis, rotundatis, ellipticis v. irregularibus, minutis, ca $\frac{1}{4}$ mm. diam., pallide cinnamomeis, epidermide diu tectis deinde poro centrale plus minus late apertis. Sporis solitarie in pedicellis ortis, ovatis, subglobosis v. ellipsoideis, interdum polygonalibus, hyalinis v. pallide flavo-brunneolis, remotiuscule subtiliterque verruculosis, 17–23 × 10–15 μ; episporio 1–1·5 μ crasso, poris germinationis haud conspicuis.

Hab. in foliis *Combreti Zeyheri* Sond., Nelspruit, leg. Liebenberg, 26038.

This rust differs from *Uredo longaensis* P. Henn. occurring on *Combretum Baumii* on the Longa River, in the character and distribution of the sori, which are more numerous on the upper than on the lower side of the leaf, and are not on leaf spots. The spores are not in chains as in *U. longaensis*.

Uredo caricis-petitianae nov. spec.

Soris hypophyllis, maculis brunneolis indeterminatis insidentibus, plus minus aggregatis v. seriatim dispositis, rotundatis v. ellipticis, usque ½ mm. longis, cinnamomeis, epidermide fissa cinctis. Sporis ellipsoideis, ovatis v. subglobosis, pallide flavobrunneis, laxe verruculosis, 25–30 × 15–22·5 μ; episporio 2–2·5 μ crasso, poris germinationis 2–3 equatorialibus praedito.

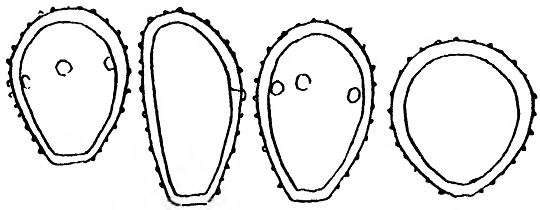


Fig. 29.—*Uredo caricis-petitianae*, spores.

Hab. in foliis *Caricis petitianae* A. Rich, in silvis Xumeni, Donnybrook, leg. Morgan et Doidge, 29830, 30107.

The sori are found almost exclusively near the tips of the long leaves; they are on irregular, brown blotches, which are small at first, but increase in size, and finally involve the whole upper portion of the leaf, which becomes brown and dead. Collections were made in winter and in early spring, but no teleuto-sori were found.

Uredo scirpi-corymbosi nov. spec.

Soris calamicolis, maculis sparsis ellipticis 1·5–7 mm. longis, 1–4 mm. latis, ferrugineo-brunneis, tandem plus minus confluentibus insidentibus, solitariis v. paucis parallele aggregatis, linearibus, 2–5 μ longis, diutissime epidermide elevata tectis. Sporis ovatis, ellipsoideis, subglobosis v. pyriformibus, pallide flavo-brunneis, subtiliter sparseque echinulatis, 27–36 × 20–25 μ; episporio tenue ca 1 μ crasso, poris germinationis obscuris (? 3–4 equatorialibus).

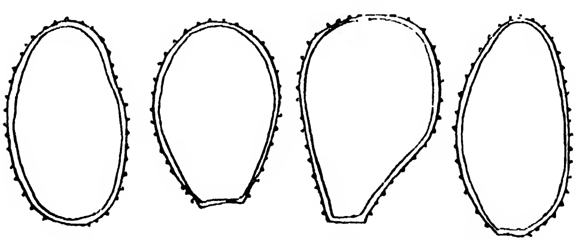


Fig. 30.—*Uredo scripi-corymbosi*, spores.

Hab. in calamis *Scirpi corymbosi* Roth., Donkerpoort, leg. Doidge et Bottomely, 29986; Skinner's Court, leg. Doidge, 23457; Onderstepoort, leg, Pole Evans, 1314; Debbe's Ravine, leg. Bottomley, 25332.

Uredo schizachyrii nov. spec.

Soris amphigenis, minutis, oblongis, ca ½ mm. longis, epidermide fissa cinctis. Sporis ovatis v. ellipsoideis, apice rotundatis v. obtuse conicis, castaneis, 30–42·5 × 22·5–30 μ, crasse sparseque echinulatis; episporio 1·5–2 μ crasso, apice incrassato usque 8 μ, poris germinationis 2–3 equatorialibus praedito. Paraphysibus numerosis, plerumque capitatis interdum clavatis, 35–62·5 μ longis, ad apicem 12·5–17·5 μ crassis; capite subgloboso brunneolo, membrana leve, valde incrassata (7·5–15 μ) et lamellata.

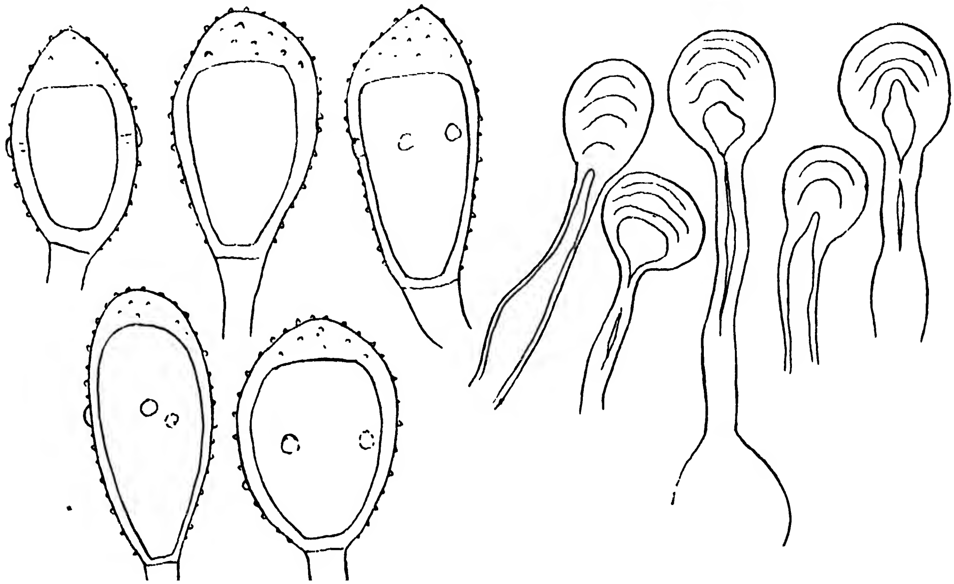


Fig. 31.—*Uredo schizachyrii*, spores and paraphyses.

Hab. in foliis *Schizachyrii semiberbis* Nees, Donkerpoort, leg. Doidge et Bottomley, 29766.

Uromyces limonii (DC.) Lev.

in Dict. d'Hist. Nat. Art. Uredinees (1840) 19; Syd. in Monogr. Ured. 1 (1904) 41.

Syn. *Puccinia limonis* DC. Fl franc. 2 (1805) 595 et Syn., p. 45.

Aecidium statices Desm. Plant. crypt. de France no. 132.

Aecidium limonii Duby Bot. Gall. 2 (1830) 904.

Caeoma staticis Rudolphi in Linnaea 4 (1829) 510.

Uredo limonii Duby Bot. Gall. 2 (1830) 1897.

(Aecidia amphigenous, often on brown or reddish leaf spots, in round groups, or elongated to 5 mm. long along the veins, usually briefly cylindrical, white, with lacerated margin. Aecidiospores angular-globose or ellipsoid, closely and minutely verruculose yellowish, 21–32 × 18–26 μ.)

Uredo-sori amphigenous, scattered, usually round, oblong on the stems, long covered by the epidermis, at length naked, pulverulent, cinnamon brown. Uredospores globose, subglobose, ovate, ellipsold or oblong, densely verruculose, yellow brown, 22–32 × 20–28 μ; epispore 1·5–2·5 μ thick, germ pores 2–3, scattered.

Teleuto-sori on the leaves and stems; on the leaves amphigenous, but usually developing more freely on the under surface, scattered or in concentric rings, round or oblong, remaining for some time covered by the blistered epidermis, which finally ruptures and surrounds the

sorus ; sori pulvinate, dark brown or almost black. Teleutospores golden brown to chestnut brown, subglobose, oblong or clavate, apex broadly rounded or obtusely conical, direct or oblique, base rounded or attenuate, 24–50 × 14–25 μ ; epispore smooth, 1·5–2 μ thick, thickened at the apex up to 10 μ ; pedicel stout, persistent, tinted brown, 5–6 μ thick at the apex and up to 88 μ long.

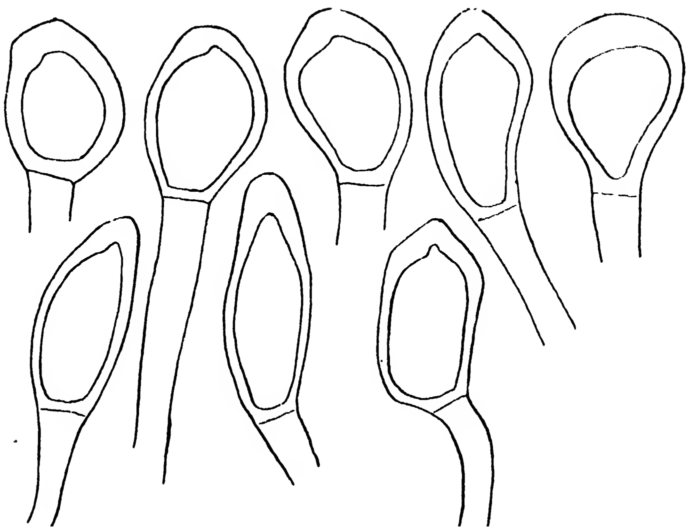


Fig. 32.—*Uromyces limonii*, teleutospores.

Hab. on leaves of *Limonium latifolium* Kuntze (= *Statice latifolia* Sm.), Pretoria, *Taylor*, 23819 ; Hartebeestpoort, *Bottomley*.

This rust has not previously been recorded as occurring in South Africa, and has only recently made its appearance in gardens where flowers are grown on a commercial scale. The leaves examined showed a gross infection. Teleutosori were abundant, a few uredospores being found mixed with the teleutospores. No aecidia were seen, the description quoted being that given by Sydow (loc. cit.).

Uromyces Strauchii Doidge

in Bothalia 2 (1928) 473.

on leaves of *Cluytia daphnoides*, Alexandria, *Doidge*, 22370.

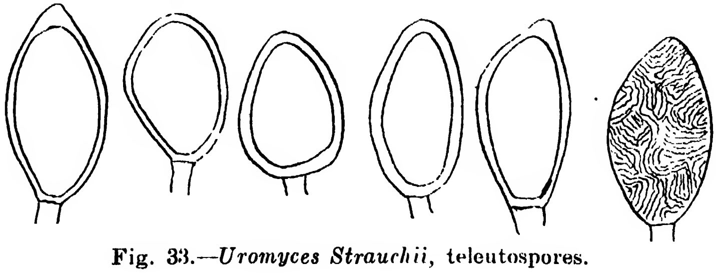


Fig. 33.—*Uromyces Strauchii*, teleutospores.

No illustration of this species was published with the original description. Drawings of the teleutospores are reproduced in the accompanying text figure, chiefly to indicate the nature of the sculpturing of the epidermis.

Uromyces antholyzae Syd.

in Ann. Myc. 2 (1904) 27 ; Monogr. Ured. 2 (1910) 252.

Uredo-sori amphigenous, not on leaf spots, or on vaguely discoloured areas of the leaf, round or transversely oblong, scattered or in transverse groups between the veins ; or caulicolous, scattered or in groups with the longer diameter perpendicular, in groups roughly oval in outline and up to 5 mm. long ; sori small, about ½ mm. diam., long covered by the epidermis. Uredospores globose or subglobose, rarely ellipsoid, almost hyaline, 17·5–23 μ diam., minutely verruculose ; epispore 1–1·5 μ thick, germ pores obscure.

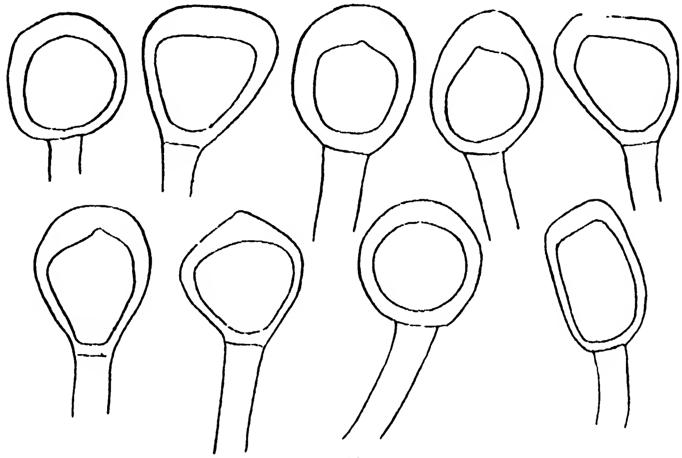


Fig. 34.—*Uromyces antholyzae*, teleutospores.

Teleuto-sori amphigenous, similar to the uredo-sori but dark brown. Teleutospores subglobose, ovate or oblong, often irregular by compression, brown, 20–25 × 15–20 μ, apex rounded, flattened or obtusely conical ; epispore smooth, 1·5–2 μ thick, thickened at the apex, 4–7 μ ; pedicel persistent, rather stout, light brown, 5–6·5 μ thick and up to 32 μ long.

Hab. on leaves and stems of *Antholyza nervosa* Thun. (= *Anapalina revoluta* N. E. Br.) Ruytersbosch, Mossel Bay, *Gemmel* (O.F.S. Herb. no. 8053) 30085.

The original description gives wider limits to the size of the teleutospores, otherwise the South African fungus agrees in every detail with the rust collected by Schimper on *Antholyza abyssinica* in Abyssinia.

This rust has been recorded on the same host by Verwoerd [in Union Department of Agriculture, Bull. 88 (1929) p. 5] from Stellenbosch, Newlands and Knysna.

Uromyces massoniae nov. spec.

Aecidiis amphigenis, maculis indeterminatis insidentibus, in greges rotundatos, v. elongatos usque 1 cm. diam. plus minus dense dispositis, cupulatis, flavidis, margine revoluto inciso, 300–450 μ diam. ; cellulis peridio in series regulares dispositis, firme conjunctis, subrhomboideis vel penta–v. hexagonis, 25–37·5 × 15–25 μ, pariete exteriore striato 7–10 μ crasso, interiore verrucoso 4–5 μ crasso. Sporis subglobosis vel ellipsoideis, plerumque angulatis, 22–27·5 × 15–22 μ, dense minuteque verruculosis ; episporio 1–2 μ crasso.

Soris uredosporiferis amphigenis, plerumque hypophyllis, sparsis, rotunddatis v. irregulariter rotundatis, epidermide fissa cinctis, pulvervulentis, cinnamomeo-brunneis, usque 1 mm. diam. Uredosporis subglobosis, ovatis v. ellipsoideis, 20–27·5 × 20–25 μ, flavis, echinulatis ; episporio 2–2·5 μ crasso, poris germinationis pluribus (?4–6) sparsis parum manifestis praeditis.

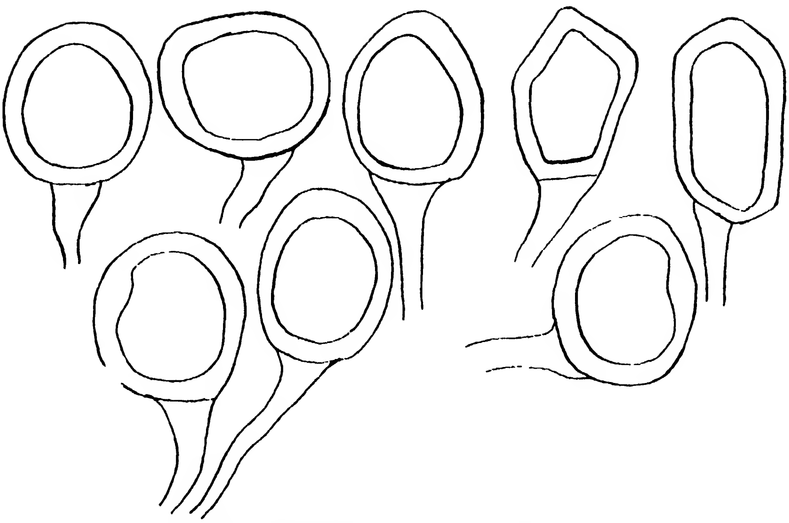


Fig. 35.—*Uromyces massoniae*, teleutospores.

Soris teleutosporiferis amphigenis circa soros uredosporiferos annulum efficientibus vel sparsis, atris, minutis, diu epidermide tectis. Teleutosporis e mutua pressione quoad formam variabilis, subglobosis, ellipsoideis, pyriformibus, saepe angulatis, castaneo-brunneis, levibus, apice rotundatis, 25–32·5 × 22·5–27·5 μ; episporio 3–4·5 μ crasso; pedicello subpersistente, 15–25 μ longo, apice leniter colorato, 5–7·5 μ crasso.

Hab. in foliis *Massoniae latifoliae* Linn. f., Fauresmith, leg. van der Plank, 25447.

Uromyces eriospermi Kalch. et Cke. affinis.

Uromyces Clignyi Pat. et Har.

in Journ. de Bot. 14 (1900) 237; Syd. Monogr. Ured. 3 (1910) 320.

Uredo-sori hypophyllous, scattered, often in series, but rarely confluent, minute, oblong' up to 1 mm. in length, long covered by the epidermis, yellow brown. Uredospores globose or subglobose, golden brown, echinulate, 22–30 μ diam.; epispore 2–2·5 μ thick with 4–7 small, scattered germ pores.

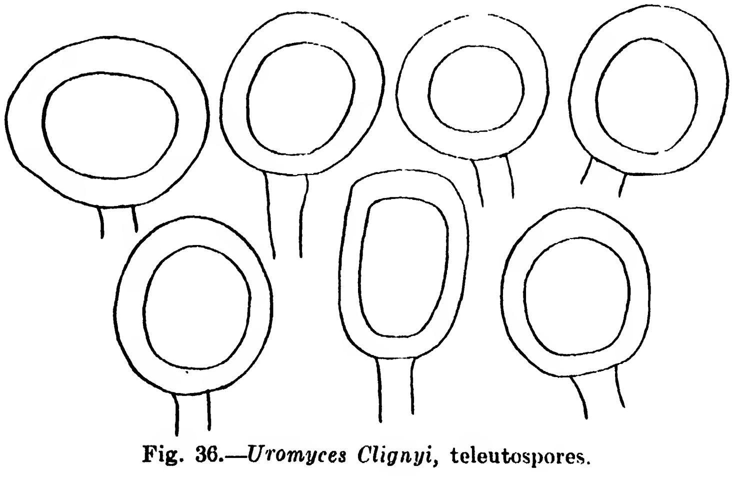


Fig. 36.—*Uromyces Clignyi*, teleutospores.

Teleuto-sori similar in form, dark brown to black. Teleutospores globose or subglobose, dark brown, becoming almost opaque, 22–32 μ diam.; epispore smooth, 4·5–6 μ thick, not thickened at the apex; pedicel hyaline, equalling the spore or longer.

Hab. on leaves of *Andropogon amplectens* Nees, Donkerpoort, *Doidge and Bottomley*, 29751; Derdepoort, *Doidge* and *Bottomley*, 29788.

This species was originally described from tropical Africa on *Andropogon* sp., and on *A. multinervis* in the region of the river Niger and in Abyssinia. It also occurs in America. *Uromyces Clignyi* has not previously been recorded on *Andropogon* spp. South Africa.

Uromyces trichoneurae nov. spec.

Soris uredosporiferis amphigenis, minutis, sparsis. Uredosporis subglobosis, late ellipsoideis v. ovoideis, saepe subangulatis, flavo-brunneis, 27·5–37·5 × 22·5–27·5 μ; episporio 1–1·5 μ crasso, brunneolo, subtiliter echinulato, poris germinationis 3 equatorialibus praeditis.

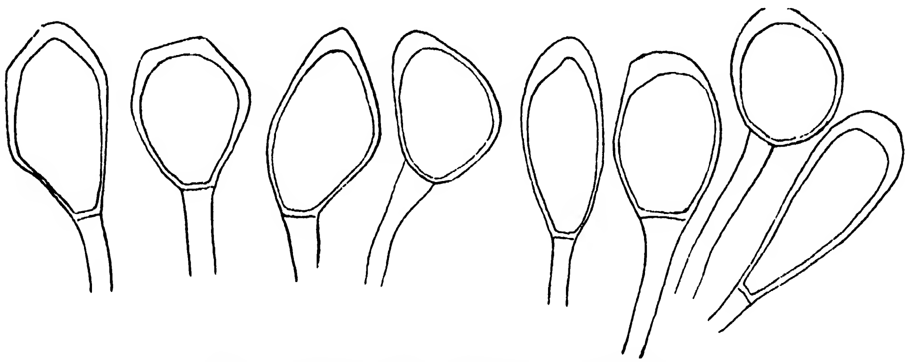


Fig. 37.—*Uromyces trichoneurae*, teleutospores.

Soris teleutosporiferis plerumque epiphyllis, minutis, usque ½ mm. longis, interdum confluendo hinc inde majoribus, usque 3 mm. longis. Teleutosporis quoad formam variabilis, subglobosis, ovatis, oblongis v. piriformibus, saepe angulatis, 20–35 × 16–19 μ, apice rotundatis, truncatis v. conicis, basi rotundatis v. attenuatis; episporio leve, 1–1·5 μ crasso, apice incrassato usque 5 μ; pedicello subpersistente, crassiusculo, apice brunneolo, circ. 5 μ crasso et usque 35 μ longo.

Hab. in foliis *Trichoneurae grandiglumis* (Rendl.) Stapf et Hubb., Donkerpoort, leg. Doidge et Bottomley, 29762; Derdepoort, leg. Doidge et Bottomley, 29792.

I am indebted to the botanists in the National Herbarium for the revision of the host plants, and in particular to Miss L. C. Chippendall, who kindly identified a large number of grasses.

Text figures were drawn to scale, but the illustrations of spores of *Puccinia* spp. have been reduced by half as compared with those of species of other genera.

A REVISION OF THE SOUTH AFRICAN SPECIES OF ADENIA.

by

L. C. C. Liebenberg

INTRODUCTION.

The genus *Adenia* was founded by Forskal on a plant collected in Arabia and which he named *A. venenata.* In the original description, the genus is stated as having 6-merous flowers. Ascherson, (1)* as pointed out by Engler, first drew attention to the fact that *Adenia* Forsk. (1775) and *Modecca* Lam. (1797) were synonymous. Engler (5) states that it is absolutely certain that *Modecca abyssinica* Hochst. and *Adenia venenata* Forsk. are identical although the former is 5-merous, explaining that it is quite possible that Forskal had a specimen with 6-merous flowers in front of him as " in the related genus *Keramanthus*, 6- and 5-merous flowers occur". Engler further explains (l.c.) that he attempted to separate the two genera but was unsuccessful. The majority of workers had apparently, as suggested by Ascherson, overlooked or not recognised this fact.

Smith (17) in 1821 substituted *Blepharanthes* Sm. for *Modecca* Lam. Wight and Arnold (20) in 1834 divided the genus *Modecca* into two subgenera *Microblepharis* Wight & Arn. and *Blepharanthes* (Sm.) Wight & Arn. Roemer (14) in 1846 divided *Modecca* into the genera *Microblepharis* (W. & A.) Roem. and *Erythrocarpus* Roem. while Bentham and Hooker (3), 1867, distinguished 2 genera *Ophiocaulon* Hook. f. and *Modecca* Lam. recognising *Clemanthus* Klotsch., *Paschanthus* Burch. and *Kolbia* Beauv. as synonyms of *Modecca.* Baillon (2), in 1888, divided *Modecca* into three sections, *Eumodecca* Baill., *Ophiocaulon* (Hook. f.) Baill. and *Keramanthus* (Hook. f.) Baill. thus further enlarging the conception of the genus by incorporation of the latter two genera. Engler (l.c.) in 1892, added two more sections to Wight and Arnold's division of the genus *Adenia* (in which *Modecca* was included), viz. *Euadenia* Engl. and *Hildebrandtiothamnus* Engl.

In 1893 Harms (6) wrote: " Von hohem Interesse ist die Anatomie der Gattungen *Adenia*, *Ophiocaulon*, *Echinothamnus* und *Keramanthus*. Es scheint mir bei diesen der anatomische Bau ganz deutlich auf eine enge Zusammengehörigkeit hinzuweisen." He (7) in 1895 subscribed to Engler's division of the genus *Adenia* in which he not only included (like Bentham and Hooker) the genera *Clemanthus* Klotsch. and *Kolbia* Beauv., but also *Keramanthus* Hook. f. each representing only one species. In 1897 he (8) further enlarged the genus incorporating 3 genera, viz. *Paschanthus* Burch. (= *Jäggia*, Schinz.), *Echinothamnus* Engl. and *Ophiocaulon* Hook. f. The first 2 monotypic genera were combined, constituting his sect. 1 *Paschanthus*, while the last, comprising some dozen closely related species in tropical and southern Africa, constituted his section 2, *Ophiocaulon* previously raised to this position by Baillon in 1888, as noted above. In addition to this the section *Hildebrandtiothamnus* (originally his sect. 4) was sunk and the genus *Keramanthus* given sectional rank as was also previously done by Baillon. De Dalla Torre and Harms (1907) have upheld this division of *Adenia* in the 5 sections, *Paschanthus*, *Ophiocaulon*, *Blepharanthes*, *Keramanthus*, *Microblepharis* and *Euadenia*. In 1921, however, the section *Microblepharis* W. & A. was not included by Harms (10) but in 1925 (11) he resuscitated it.

*** Figures in parenthesis refer to "Literature Cited" on page 544.**

None of these sections, as defined by Harms, will allow for the inclusion of *A. glauca* and *A. spinosa,* two apparently very closely related species, differing mainly in the presence of spines and simple leaves in the one species as opposed to compound leaves in the other species—both without glands (" Coronaschuppen ", etc.). Harms (11) includes *A. glauca* in *Blepharanthes* presumably based on Schinz's description of this species in which he (Schinz) described the petals as " im Grunde des Receptaculums inseriert " which the present writer did not find to be the case. (See discussion under *A. glauca* on p. 523.) The following is a summary of the synonymy of the genus *Adenia* Forsk. accepting the conception of Harms [presumably based, to some extent at least, on his extensive studies of anatomic characters (referred to elsewhere)] and certain other workers mentioned above :—

1775. Adenia Forsk. Fl. Aeg. Arab., p. 77.
1797. Modecca Lam. Encycl. meth. bot. lv., 208.
1807. Kolbia P. Beauv. Fl. d'Oware et Ben., 11.91.
1821. Blepharanthes Smith Gramm. of Bot., 188.
1822. Paschanthus Burch., in Burch. Travels 1, 543.
1846. Microblepharis M. Roem., Synops. 11, 133, 200.
1846. Erythrocarpus M. Roem., Synops. Mon. 11, 204.
1863. Clemanthus Klotsch., Peters Reise Mossamb. Bot., 143.
1867. Ophiocaulon Hook. f., Gen. Plant, 1, 111, 813.
1876. Keramanthus Hook. f., Bot. Mag. T., 6271.
1889. Jäggia Schinz., Verh. Bot. Ver. Brand, XXX, 253.
1891. Echinothamnus Engl., Bot. Jahrb. 14, 383.

The genus has attracted attention in South Africa mainly as a result of the poisoning of human beings from *A. digitata.* In 1922 poisoning (and one death) of adults was reported as a result of the chewing of the tubers of *A. digitata* which were mistaken for that of a cucurbitaceous plant. Previously Burtt Davy reported death and poisoning of children as well as suspected poisoning from this species. In 1928 death of a child and poisoning of others were also ascribed to this species. A study of its poisonous principles at the Veterinary Research Laboratory, at Onderstepoort,* revealed two toxic principles, hydrocyanic acid and a toxalbumin, " Modeccin ". Steyn (18) reports that hydrocyanic acid has been found in the fresh leaves of this species as well as that of *A. glauca,* but in the latter case not in the " root " which he states is edible. Dr. E. E. Galpin reported in December, 1931, that he had observed children eating the fruits of *A. glauca,* which they said were very nice. According to Watt and Brandwyk (19), *A. senensis, A. gummifera* and *A. Kirkii* are used medicinally.

Harvey states that the fruits of *A. hastata* are edible ; Bryant states that *A. repanda* is greedily eaten by stock which is also reported for *A. hastata* ; Potts (13) states that natives, when thirsty, suck the sap of the " tuber " of *A. multiflora,* but this information must be incorrect as will be explained further on, and the confusion is very probably attributable to the fact that *A. glauca* occurs in the same locality and is nontoxic and edible. Forskal described *A. venenata* as having poisonous tubers while *A. palmata* is also said to be poisonous.

The South African species which represent only a very small percentage (approximately 10 per cent.) of the world's species have been recorded mainly from the Transvaal. The genus is largely restricted to the tropics of the old world and from Africa approximately 50 species have been described. It is of more than usual interest as it exhibits some most interesting plant forms (Plates 1, 2, 3 and 4).

*** Green, H. H., and Andrews, W. H., 1923 : The toxicity of *A. digitata* Burtt Davy (Modecca digitata Harv.) 9th and 10th Rpt. Dir. Vet. Educ. & Res., pp. 381-91. Green, H. H., and Kamerman, P., 1924 : The protein phytotoxin with special refce. to the new " modeccin " Journ. S.A. Chem. Inst. 7, pp. 3-5.**

There are in South Africa (and South West Africa) the desert-arid region forms, *A. repanda* (Burch.) Engl. and *A. Pechuelli* (Engl.) Harms, the latter being a plant of very strange habit. At the other extreme there is the interesting, widely distributed, liana, *A. gummifera* (Harv.) Harms, which often grows to enormous size with very long woody thick stems, up to 2½ and 3 inches diameter. Intermediate forms are represented by several species in South Africa, two types being distinguished, viz. one with a fleshy swollen axis partly or largely above the soil (Plates 1–4), the other with a tuberlike underground portion from which the annual branches arise. In the former case the green or above-ground swollen main axis assumes more or less characteristic shapes in the different species. Of this type there are only 4 described species, one, *A. globosa* Engl., occurring in East Africa, the other 3 having been recorded from South Africa and that, with the exception of two specimens only, from the Transvaal. Judging from the figures of the spinescent *A. globosa* Engl., it would seem that this species is not closely related to any of the 3 South African species of similar habit, amongst which there is also a spinescent species.

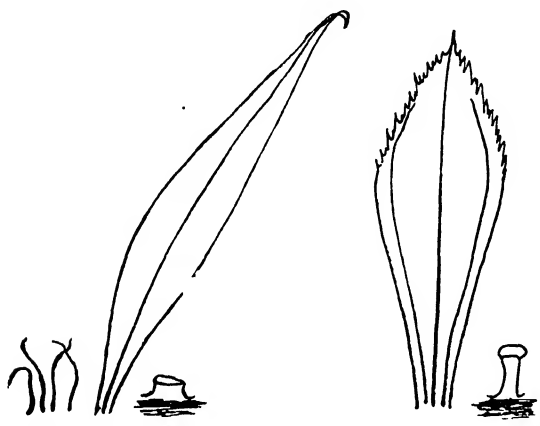


Fig. 1.—Variation in petal, gland and coronal processes in two flowers from Obermeyer in Trans. Mus. 29287, ♀, belonging to *A. digitata* (Harv.) Engl.

Fig. 2. -Two petals from two different flowers from Liebenberg 3366, ♀, belonging to *A. digitata* (Harv.) Engl.

The Root-stem Relations.

In the absence of anatomic proof the writer has adopted the view that the tuberlike structure when below ground only (which is normally the case in *A. repanda*, *A. senensis*, *A. Wilmsii*, *A. digitata* and *A. hastata*) is entirely a root structure except for the attenuated perennial portion at the top thereof, from which the annual branches arise and which is formed from accumulated annual growths or from elongation or enlargement of the bud-producing zone. When the swollen perennial main axis is largely or partly above the ground (as in the case of *A. fruticosa*, *A. spinosa* and *A. glauca*) then the underground portion is regarded as root structure and the aboveground part (green portion) as stem structure, the soil level being regarded the line of demarcation between the two kinds of structures. The annual axes or stems are referred to as branches. This characterisation is resorted to only as a matter of convenience for the description of the species.

MORPHOLOGICAL NOTES AND STUDIES.

The Flower.

The classification of certain species of *Adenia* is not only made more difficult by leaf heterophylly but also by polymorphism and the presence of male and female flowers on different individuals (very rarely on the same individual) and to some extent by marked variations in floral structures, within the species, although on the same individual there usually appears to be little variation (figs. 1, 2 and 3). It may be pointed out that in the majority of the species polymorphism is very apparent, the difference in structures of the flower being marked in the two sexes apart from the obvious differences (abortion of androecium and gynaecium respectively) as a result of the unisexual nature of the flower. This is particularly characteristic of the petals.

In the literature there are two interpretations of the morphology of the flower parts and the writer has adopted the interpretation which follows hereunder, in which is included a description of the main features of the flower.

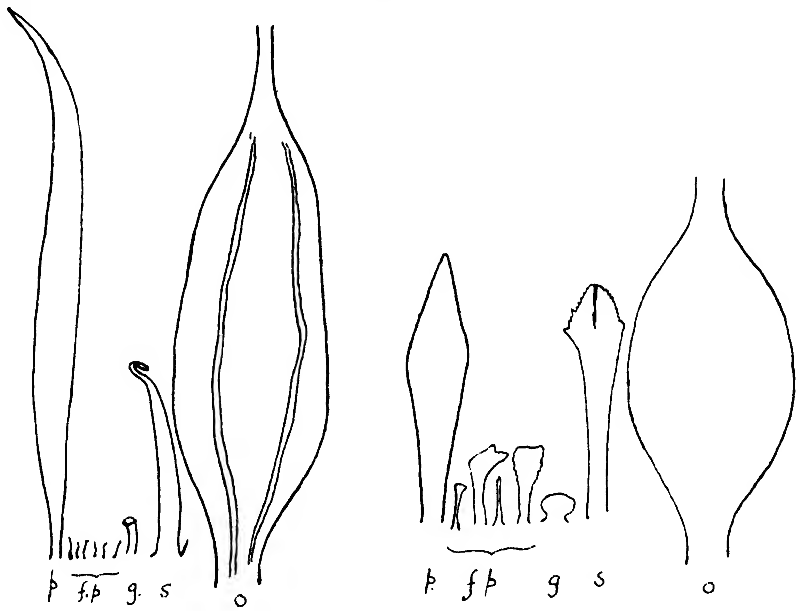


Fig. 3.—Variation in petal, gland, coronal processes, ovary and staminode in two flowers A and B from Liebenberg 3056, ♀, belonging to *A. digitata* (Harv.) Engl. A is from the original specimen and B from a specimen grown in the gardens of the D.P.I. o, ovary; s, staminode; g, gland; fp, coronal processes; p, petal.

Receptacle.

That part of the flower more or less below the "glands" (q.v.) and above the articulation with the pedicel. The articulation is never absent.

Calyx tube.

Part of the "receptacle" of Harms, Engler, etc.

Calyx lobes.

(5). The "sepals" of Harms, Engler, etc.

Corolla.

Petals 5, alternating with the calyx lobes, inserted at the sinuses of the latter or at varying depths on the calyx tube, depending upon the species.

Corona.

The filiform processes which arise from the calyx tube near its base and are arranged in a sinuate ring or in groups in a circle. " Korona " (in part) or " Effigurationen " (in part) of Harms. This is homologous to the prominent structure in certain other genera of the family, e.g. *Passiflora.*

*Androecium.**

In the male flower 5 stamens and in the female flower 5 staminodes either free or otherwise connate for part of their length at the base. The staminal or staminodal column is adnate to the receptacle (? and/or calyx tube), at 5 points (always opposite the petals), so forming 5 depressions or pockets from the base of which arise the " glands ".

*Gynaecium.**

In the female a normal stipitate ovary with numerous ovules on 3 placentae (parietal) and a 3-branched style and pufflike stigma. In the male an abortive structure semiterete linear-cylindric in shape somewhat tapering upwards, surrounded by the staminal column. The fruit is a capsule, normally 3-valvate, dehiscent or indehiscent, with anatropous arillate seeds.

Glands.

(5). The 5 structures which arise from the base of the pockets or depressions and which alternate with the petals. " Receptaculumeffigurationen," " Zungenförmige Schuppen," " Corona Schuppen," " Schuppenförmige Effigurationen," " Outer staminodes," " glands of the disc." This term (gland) is used for convenience, as these structures may actually be " Outer staminodes " or even the vestiges of an aborted coronal structure. Absent in certain species.

The slender processes (" corona ") vary a great deal in the various species, being rudimentary in certain individuals or certain of the South African species. Their absence, together with the absence of glands in any particular species may perhaps be looked upon as a sufficiently strong reason to exclude such species from the genus *Adenia.* These processes when numerous or in a continuous circle around the calyx tube very often appear to arise from the edge, or to be the lacerated margin or upper part, of a membranous tissue which lines the base of the calyx tube (? or uppermost part of the receptacle) and it is apparently also this same tissue which joins the filamental column (collar or tube) formed by the connate filaments or staminodes, to the base of the calyx tube at 5 points, so forming the 5 pockets or depressions. This membranous tissue is often clearly seen in certain flowers (when dissected) and such a wider conception of the corona seems also to be justified by the occurrence of these processes on the tissue joining stamens to calyx (and/or receptacle ?) n such species as *A. glauca* or *A. spinosa.*

The Inflorescence.

The inflorescence in *Adenia* presents interesting features and in order to understand these and the variations better, particular attention was paid to it. The main features n the various species are discussed elsewhere. At this stage the general features will be dealt with.

Harms (9) has made a special study of the morphology of the inflorescence and tendrils in the *Passifloraceae.* Speaking about the " Inflorescenzträger oder Pedunculus ", he states that for *Adenia* : " Dieser trägt seltener nur einen, meist zwei Seitenäste, während er in der Mitte in eine Ranke auslaüft. Die blütentragenden Seitenzweige zeigen cymöse Verzweigung in mannigfacher Art und verschiedenem Grade ". The typical *Adenia* inflorescence is a longer or shorter " peduncle " terminating in a tendril and having two

* As stated, in the S. African spp. dioecism is practically the rule.

opposite or alternate side branches or " *cymes* " which may be repeated one or more times. Common variations—with reference to the South African species—are (1) the absence (non-development) of one or both cymes, when the peduncle may terminate in a flower-bearing pedicel ; (2) the peduncle terminating in a pedicel.

Harms further states : " Im allgemeinen wiederholt sich die dichasiale Verzweigung mit Ausbildung einer Mittelblüte einige wenige Male oder es gehen durch Fehlschlagen eines der beiden Seitenästchen die Dichasien schon bald oder erst by Achsen höherer Ordnung in Monochasien über ". Presumably under dichasial branching Harms includes those cases where the side-branches (" Seitenästchen ") are not only opposite but also alternate and this is essentially the nature of the inflorescence in the South African species, in which sidebranches are always alternate except perhaps those (of the first order) arising on the peduncle. In the South African species the standard groundplan for the inflorescence is one in which each relative main axis (always with terminal flower) has usually two lateral branches with a tendency either towards the monochasial (only 1 bract, with or without its side-branch present) or towards the trichasial or pleiochasial* (where more than 2 alternate bracts, with or without their side-branches are present).

The switching over to a mono-, tri-, or pleiochasium, particularly the latter two, is apparently of unusual occurrence in the South African species because the youngest relative main axes practically always bear two alternate bracts with buds. On the older axes, however, this may sometimes occur.

In accordance with the law of development in the cymose inflorescence, the uppermost side branch of each relative main axis is the oldest (and most developed) and naturally flowers on this are relatively older than those of the branch below it. The branches of any relative main axis are always alternate, and it very rarely happens that such branches fail to develop in due course, i.e. is only represented by a bract, without a bud, unless of course they are the youngest bracts on the inflorescence. That portion of each relative main axis which bears the flower (that is the pedicel) is often pushed aside and is less developed than the side-branches.

All flowers (by definition) are borne terminally on each relative main axis (which may or may not be repeated one or more times) and are therefore pedicillate, besides being articulate. Not only does the distance between the side-branches (or their bracts) vary a great deal in different species but also on the same inflorescence or on the same or different individuals. The pedicel length is subject to similar variation due to the position of the oldest (or nearest) relative bract very rarely being so short as to appear to be lacking or almost so, as, for example, in *A. Wilmsii*.

If then the side-branches remain undeveloped and their respective bracts are displaced to their uppermost limit (i.e. bordering the articulation) the flower will appear sessile and bracteolate. This is observed in *A. Wilmsii* (fig. 13). Further modification gives us the inflorescences of many species of *Passiflora* as pointed out by Harms and others. In these the " peduncle " has undergone maximum reduction so that tendril and side-branches (or only 1 side-branch) arise side by side in the axil of the leaf having their bracts forced (displaced) on to their respective axes thus giving on each 3 bracts (2 bracteoles and 1 bract)† which in the various species of *Passiflora* assume various positions or modifications from the three scattered narrow bracts to involucra of various shapes and sizes.

Although, to some extent, the characters of the inflorescence differ somewhat in the different species and are fairly constant for certain species, there is a marked variation in one or two of the species (e.g. *A. digitata*) and they would therefore not appear to be suitable for the characterisation of species.

* A 4th side branch, represented by a bract, has only been observed once (in Fig. 15).

† This is not uncommon in the case of *A. glauca*.

Harms refers to inflorescence dimorphism in the two sexes, e.g. in *A. venenata* but such has not been established for the South African species. He also records the occurrence of " traubenähnliche Blütenstände " in certain species, in which category the reproductive branchlets of *A. gummifera* and *A. Wilmsii* may presumably be placed.

The interesting behaviour in *A. gummifera* (Harv.) Harms, to which Engler and Harms have drawn attention, should here be mentioned. In this species (and presumably in related species, according to these workers) there are usually 2, sometimes 3, buds in the axils of the leaves, the lowermost of which develops into a tendril or strong inflorescence, the other into a branchlet of varying size. This branchlet may at times give the impression (with leaf abscission or ? non-development of leaves) of being a compound inflorescence. As noted elsewhere these " secondary " inflorescences of the branchlets, apparently (in the South African specimens), always (?) end in pedicels, not in tendrils. Presumably Engler and Harms have only observed this branchlet (" Seitenzweig Spross ") above (i.e. in the axil of) a tendril and not above an inflorescence. In the South African material, this branchlet has been observed above a strongly developed inflorescence in which the main axes (peduncles) terminate in tendrils.

Variation and Abnormalities in the Species.

In his researches on the utilisation of the anatomic structure for the limitation and division of the *Passifloraceae*, Harms in 1893 drew attention to the differences as well as variations, in the anatomic structures exhibited by the various related genera and species of the *Passifloreae* (including *Modecceae*) for the latter group of which he particularly suggests the possible value of characters like " Bau des Holzes, die Excrete des Blattes (Krystalzellen, ' Drüsen ', Gerbstoffbehälter) und die Haarbildung ", the latter term being used in a sense to include the curvature of the cells of the epidermis. At the same time he points out that a number of these characters vary a great deal and should only be used with care for the limitation of species, although the above-mentioned characters as well as others such as strength of outer epidermis walls, structure of mesophyll, etc., could be utilised for such purpose.

In the revision of the South African species, the present writer has experienced great difficulty in classifying certain specimens belonging to a group which he has referred to as the " digitata-senensis-complex ". He has observed great variation in leafshape, in glands and in the number of " ruby-coloured " or giant cells (presumably the " Gerbstoffbehälter " of Harms) on the upper and lower surfaces of the leaves of specimens of the same species and even on the same specimen, as well as variation in the waxy covering in the same species. Variation in the " ruby-coloured cells " (viz. the " Gerbstoffbehälter ") is only a reflection of the anatomic variation of the species. In view of this fact and the variation observed by Harms for several of his anatomic characters (in the same species) the writer does not feel that the classification of a difficult group like the " digitata-senensis-complex " would be much facilitated by the study of anatomic differences. Differences in anatomic characters would no doubt be more marked in the case of those plants that are not so closely related or those that are easily separated on morphological characters. Whether, however, anatomic characters will have taxonomic value in cases where the comparatively numerous morphological characters have failed, that is, where the latter vary so much that classification is impossible or very difficult, seems doubtful.

A. hastata (Harv.) Schinz

In this species fairly wide variations are evident in the characters of the inflorescence; in size and stoutness of the inflorescence, including tendril and in stoutness of tendril in relation to the peduncle. The " cymes " are usually opposite and few of the peduncles terminate in pedicels, tendrils being usually present. In the number of flowers to a " cyme " there is a wide difference. The majority of specimens have 1-flowered or 1- to 2-flowered

cymes but several specimens are up to 5- or 6-flowered (or more ?). On the same specimen the number of flowers to a cyme is quite constant. It may be noted that of three sheets of Rogers 12606 one sheet showed typical 1-flowered " cymes ", while the other two were both many-flowered.

It is interesting to note that the apical glands of the leaf (paired glands at the apex of the leaves) are sometimes absent on some specimens.

In figs. 4 and 5 two drawings of inflorescences of this species are shown.

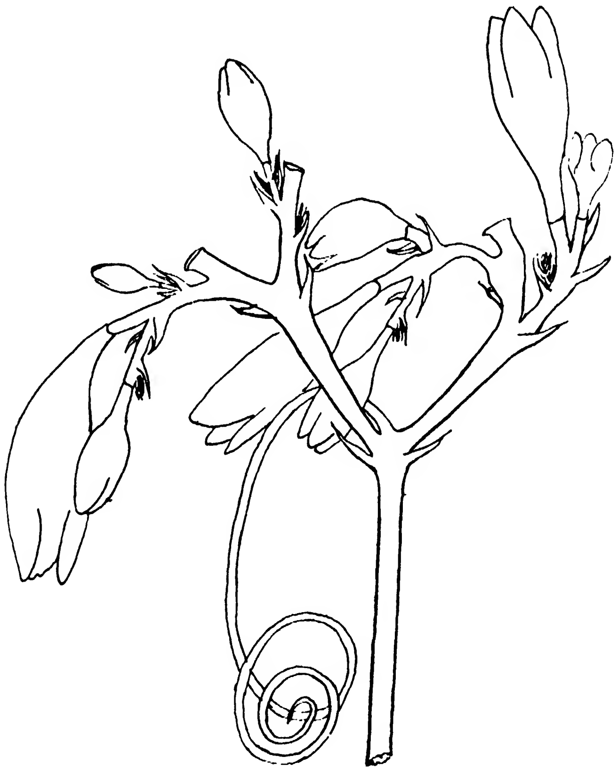


Fig. 4.—Typical inflorescences of *Adenia hastata* (Harv.) Schinz., enlarged several times. From Rogers in Trans. Mus. 13273, ♂.

Very great variations were observed in size and shape of flower and the parts thereof. This was particularly noticeable in the case of the petals which varied from entire or almost so, in some specimens, to the characteristic fimbriate ones (the processes of the petals being of very variable length) of the species, in the males.

The following abnormalities were observed :—

Rogers 13273 : A sixth petal arising much below the others and differing somewhat from them.

Thorncroft 2034 : Calyx lobes and petals 4-merous (stamens 5). Apparently only 1 flower of this nature.

Breyer 17956 : Small leaves in axils of some inflorescences.

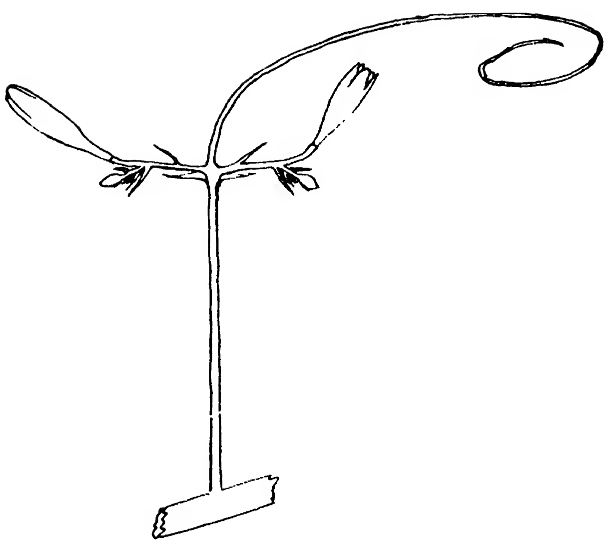


Fig. 5.—Typical inflorescences of *Adenia Hastata* (Harv.) Schinz., enlarged several times. From Thorncroft 2034, ♂.

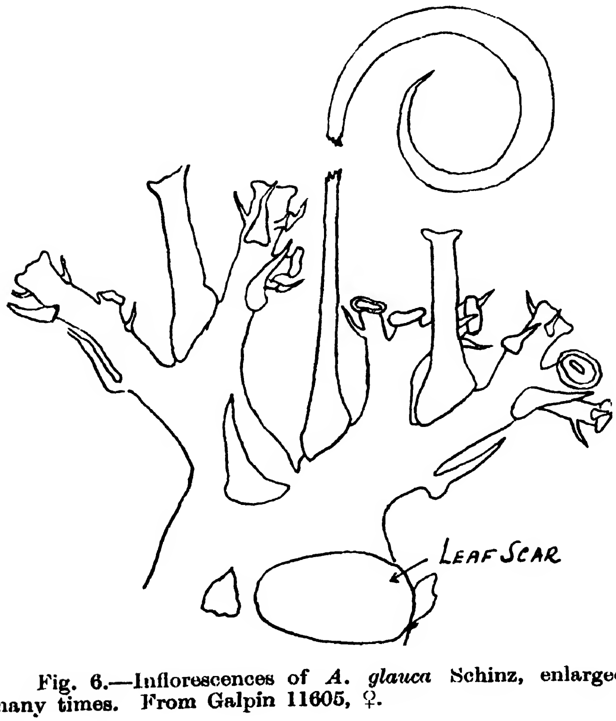
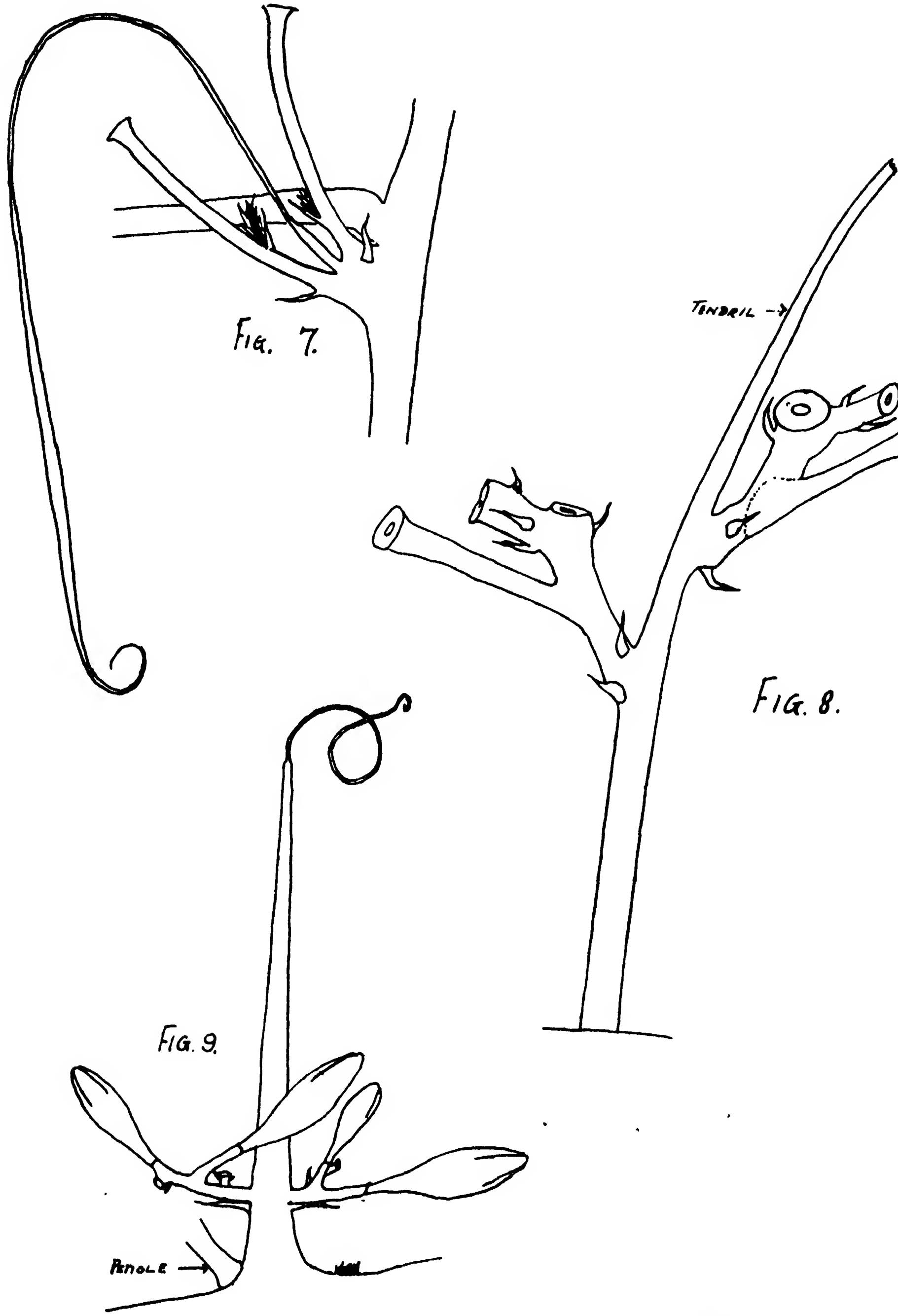


Fig. 6.—Inflorescences of *A. glauca* Schinz, enlarged many times. From Galpin 11605, ♀.



Figs. 7 and 8.—Inflorescences of *A. glauca* Schinz, enlarged many times. 7 and 8 are from Galpin 13197, ♀.

Fig. 9.—A typical inflorescence of *A. spinosa* Burtt Davy, enlarged many times. From Bremekamp and Schweickerdt in Trans. Mus. 29882, ♂.

A. glauca Schinz

Except for fairly marked variations in the inflorescence, this species is fairly uniform in its flower parts.

What is unique is that occasionally the inflorescences are clustered at the bases of flowering shoots or of branches or of branchlets but also often occur at the bases of tendrils and in these cases the " cymes " are very contracted or apparently only represented by single pedicels (with flowers) on very reduced peduncles. In the latter cases there are no tendrils, though peduncles usually end in tendrils. Usually, however, inflorescences are axillary (axils of leaves) fairly short (with no visible peduncles) with " cymes " 1- to 2-flowered but occasionally many-flowered, ending in tendrils though not infrequently in long (flower-bearing) pedicels. Like the stipules the bracts are reddish brown and those of the undeveloped side-branches are often found to be displaced along their respective axes.*

In figs. 6, 7 and 8 two typical inflorescences are shown. No abnormalities were observed.

It should be pointed out here that the writer has not been able to find any glands in this species although marks were observed (grouping of " veins ") coinciding with the position of glands in the ordinary *Adenia* flower. Schinz in describing this species (l.c.) states that " Die unanschaulichen Receptaculumeffigurationen, die den Staminodien opponiert sind, haben zungenförmige Gestalt ". He further states that the petals " finden wir im Grunde des Receptaculums inseriert ". The present writer has always observed the petals to be inserted at the sinuses of the calyx lobes (" Kelchblätter " of Schinz), that is at the upper margin of the " Receptaculum ".

A. spinosa Burtt Davy

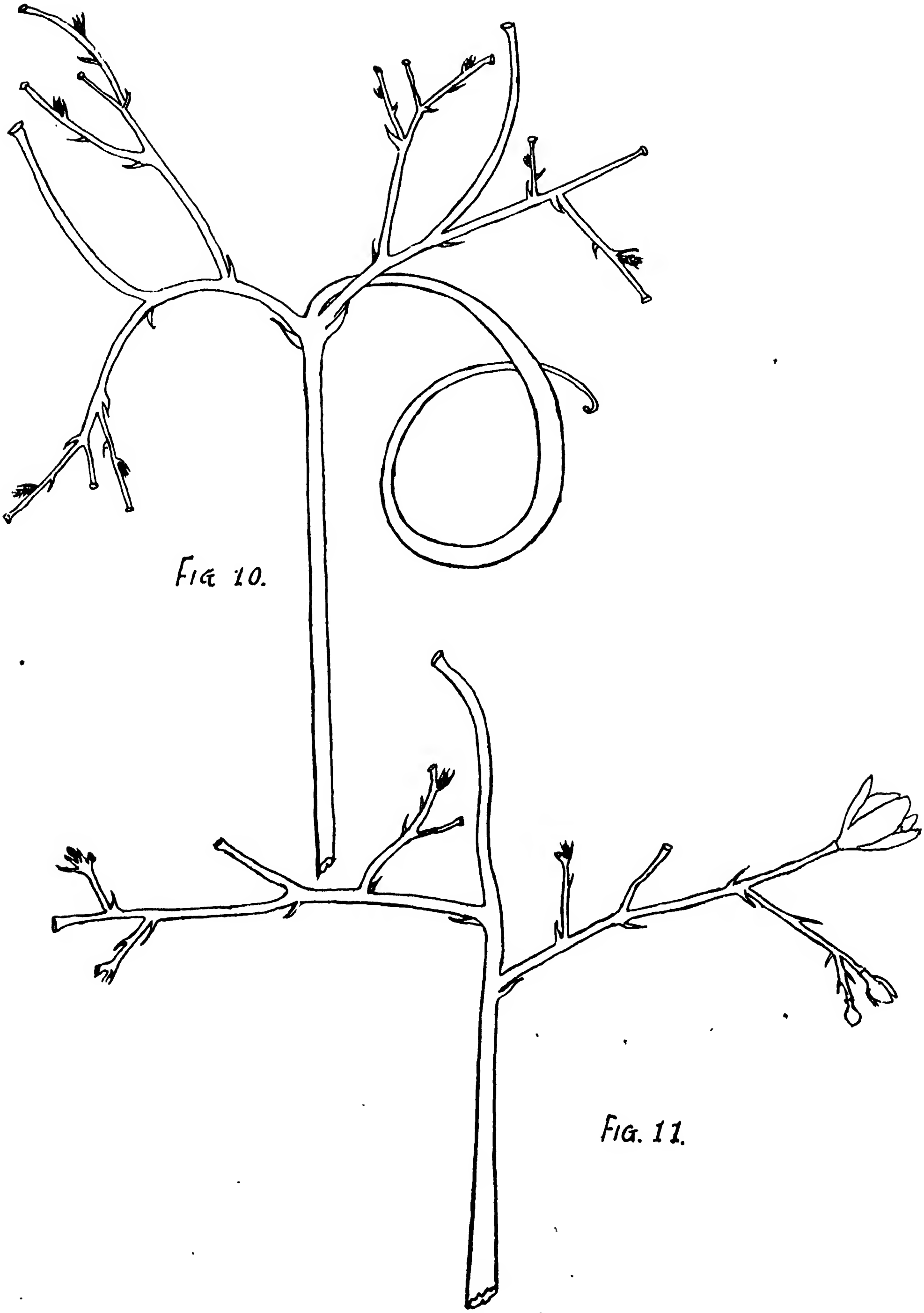
In this species the inflorescences are usually axillary (axils of spines or those of leaves), the " cymes " being many-flowered although occasionally 1-few-flowered. Inflorescences are usually much reduced (compact). Such reduced inflorescences not only occur in the axils of spines but are, not infrequently, also clustered near the base of the latter. The thorn may be considered as the modified main axis of the inflorescence for not only does it often function as a tendril, but it usually has buds near the base corresponding to the position of the main branch of the inflorescence and, in fact, occasionally possesses normal cymes (Bremekamp and Schweickerdt 469 in Transvaal Museum). This type of inflorescence is shown in fig. 9. It also is of interest to record the presence of leaves in, what appears to be, normal, axillary, reduced inflorescences. There are usually 2 to 3 flowers present and such inflorescences are perhaps to be regarded as very reduced branchlets, arising, it would appear, in the axils of spines, not in those of leaves, as axillary inflorescences do. Presumably such branchlets should be interpreted as truly axillary, being the development of a second bud in the leaf axil.

No abnormalities or marked variations were observed.

A. gummifera (Harv.) Harms

The occurrence of both primary and secondary inflorescences is interesting. The former occur in axils of leaves while the latter occur on almost leafless branches which arise in the axils of primary inflorescences. Secondary inflorescences are not visibly axillary as leaves have often not developed or have dropped early. The 1-many-flowered " cymes " are usually alternate and usually the peduncles end in tendrils (though sometimes in pedicels), but " cymes " are occasionally also opposite. One or both of the cymes may be undeveloped (rudimentary) when they are represented by their bracts only or very little besides. Not infrequently the inflorescence consists only of 2 bracts and a long terminal flower-bearing pedicel. Peduncles are usually well-developed, particularly in the primary inflorescences where they are often very long (up to 10 cm.).

* The bases of tendrils and the pedicels of the primary branches are also red-coloured.



Figs. 10 and 11.—Inflorescences of *A gummifera* (Harv.) Harms, enlarged several times. 10 is from Wylie in Natal Herb. 23313, ♀. 11 is from Watt and Brandwyk 1497.

In Figs. 10 and 11 two inflorescences of this species are shown. No abnormalities were observed.

With regard to floral structures, it can be recorded that this species does not show any marked variations and neither are the variations in other morphological characters very pronounced. Although differences in leaf shape, leaf size, number of large " Gerbstoff-zellen " (black dots), etc., are quite noticeable.

A. repanda (Burch.) Engler

The inflorescences are usually small, insignificant, the bracts characteristically long. In some cases, particularly at the base of branches, they are so reduced that the flowers appear to be solitary, the " cymes " being rudimentary and the shortened peduncle terminating in a flower-bearing pedicel, not a tendril. Inflorescences are axillary. The " cymes " are very rarely opposite and one or both of them may develop, usually only the one develops; it may be the lower or the upper. The " cymes " are characteristically 1- to few-flowered. The peduncles end in pedicels (this usually is the case at bases of branches) or tendrils (usually this occurs towards apices of branches). Occasionally both cymes are undeveloped.

In Fig. 12 are shown some typical inflorescences.

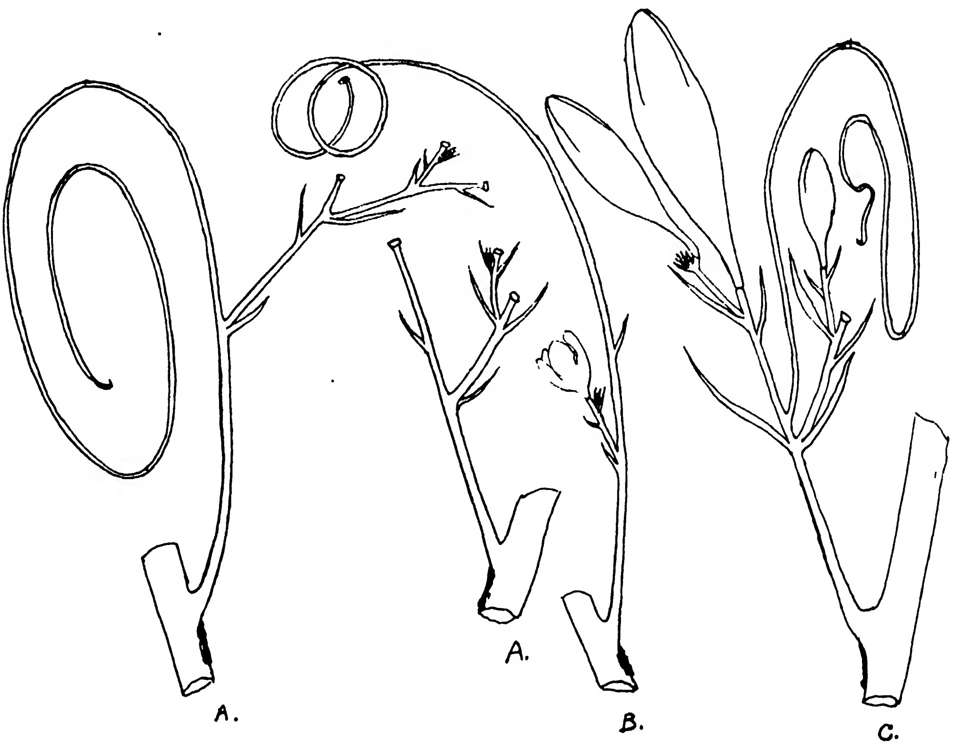


Fig. 12.—Inflorescences of *A. repanda* (Burch.) Engl. several times enlarged. A is from Pearson 8166 (Natal Herb.), B is from Dinter 4516, ♀, and C is from Marloth 1092, ♂.

On the whole this species is very uniform, showing a very narrow range of variation except perhaps for the insertion of petals. No abnormalities were observed other than 4 small sessile flower buds (side by side) on one of the tendrils in Marloth 1092 (in National Herbarium).

A. Wilmsii Harms

Of this species only a few specimens are available and the variation is not great except for leafsize. The species appears to produce different types of shoots, that is vegetative, reproductive and normal and these do not, apparently, arise at the same time on the same plant. The normal shoots have 1- to 3-flowered axillary inflorescences with the main axis (peduncle) always terminating in a flower and not a tendril. This terminal flower of the main axis is normal but one or both of the sidebranches (of the main axis) may be undeveloped. The reproductive shoots are reduced main stems with several alternate axillary inflorescences in which the leaves are considerably reduced, almost bractlike and the inflorescences more elaborate than in the normal shoot. The bracts on the main axis of the inflorescence or on any of its sidebranches may occupy any position on their respective axes and may sometimes be so close to the articulation as to give the flower the appearance

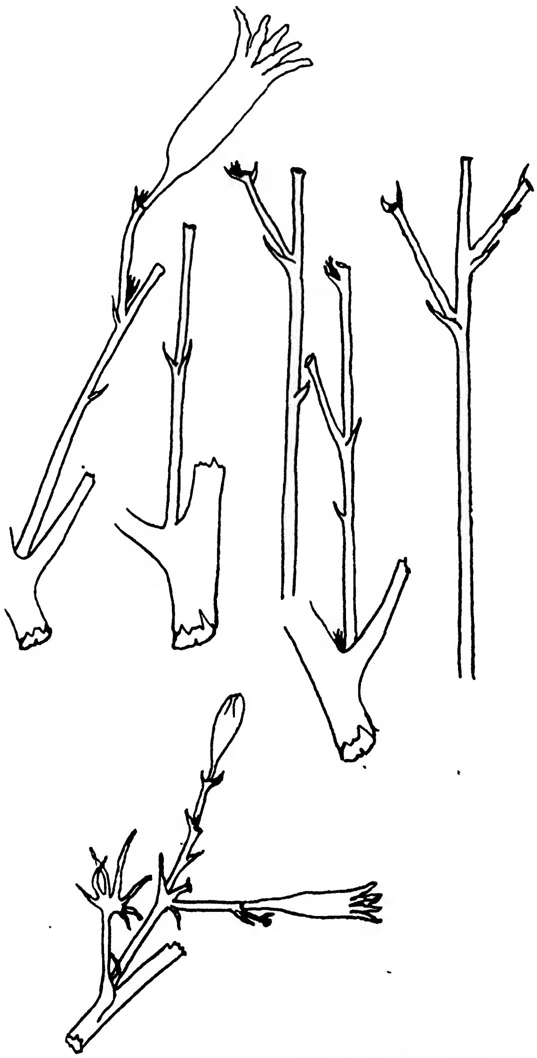


Fig. 13.—Inflorescences of *A. Wilmsii* Harms, several times enlarged. From specimens colld. by Miss van Wyk (Nation. Herb.).

of an axillary origin. In Fig. 13 inflorescences are depicted. The glands or nectaries at the apex of the pedicel are sometimes present in 2 pairs and not 1, which fact along with unusually broad petiole and peduncle, as well as the extra pair of lobes (7 altogether) rather suggests a degree of fasciation as being hereditary for this species which character may possibly have arisen as a mutation in the original species from which it was evolved.

A. digitata (Harv.) Engl.

In this species very marked variations were observed. The variation in leaf characters, particularly in shape and number of leaf lobes is a very striking feature as can be gauged from the photographs (Plates 16–36). As pointed out further on some of these forms had been mistaken for new species by other workers. In characters of the inflorescence and of flowers the variations are almost equally striking. Thus, the peduncle which is generally about 2 cm. long may often be absent or up to 6·5 cm. long. Or again, the flowers, which are usually 4–12 per inflorescence may often be only 2 and sometimes as high as 40 or 80. The distribution of giant cells (Gerbstoffbehälter) on the underside of the leaf has also been observed to be extremely erratic even on the same specimen and on the same leaf. Some typical inflorescences are shown in Figs. 14–17.

A few abnormalities were noted as follows: *Osborne in Nat. Herb.* (2639), 3 glands. *Rogers* 24185 bract adnate to the receptacle, 6 calyx lobes, 6 stamens and in a second flower only 4 stamens and 3 minute peglike outgrowths from the base of the anther. *Galpin* 13196, 2 stamens have their anthers and free filaments connate. *Breyer in Trans. Mus.* 24215, 1 flower with 6 calyx lobes and 6 stamens.

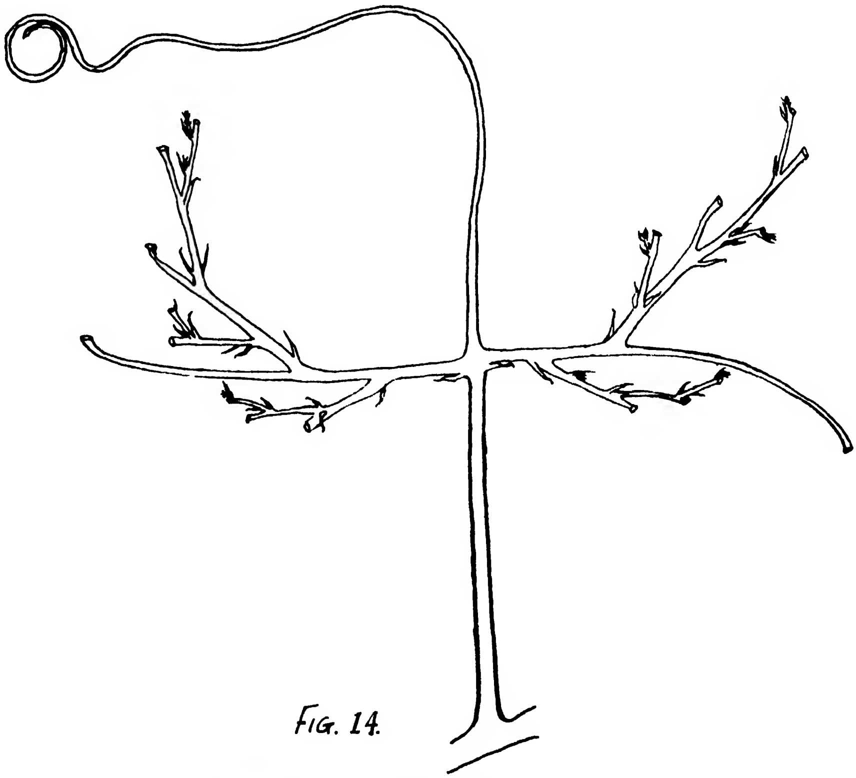


FIG. 14.

Fig. 14.—Inflorescence of *A. digitata* (Harv.) Engl., from Schweickerdt in Trans. Mus. 30164, ♂. Enlarged.

A. fruticosa Burtt Davy

Inflorescences are 1- to 3-flowered, axillary; peduncles lacking or up to 3 or 4 mm. long, ending in normal flowers not tendrils, the latter being bracteacte or non-bracteate, strong or weak. Tendrils occur in axils of leaves and branches in axils of tendrils. Leaf size is very variable.

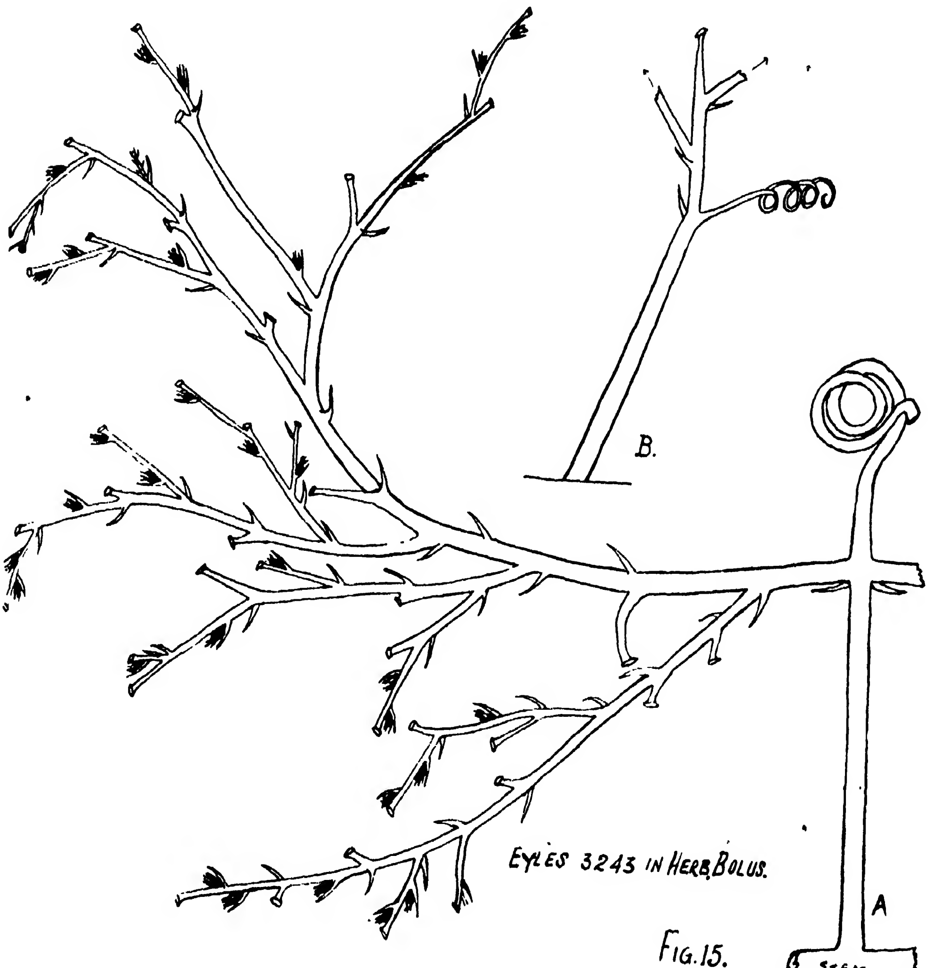


Fig. 15.—Inflorescence of *A. digitata* (Harv.) Engl., from Eyles 3243 (Bolus Herb.). Enlarged several times.

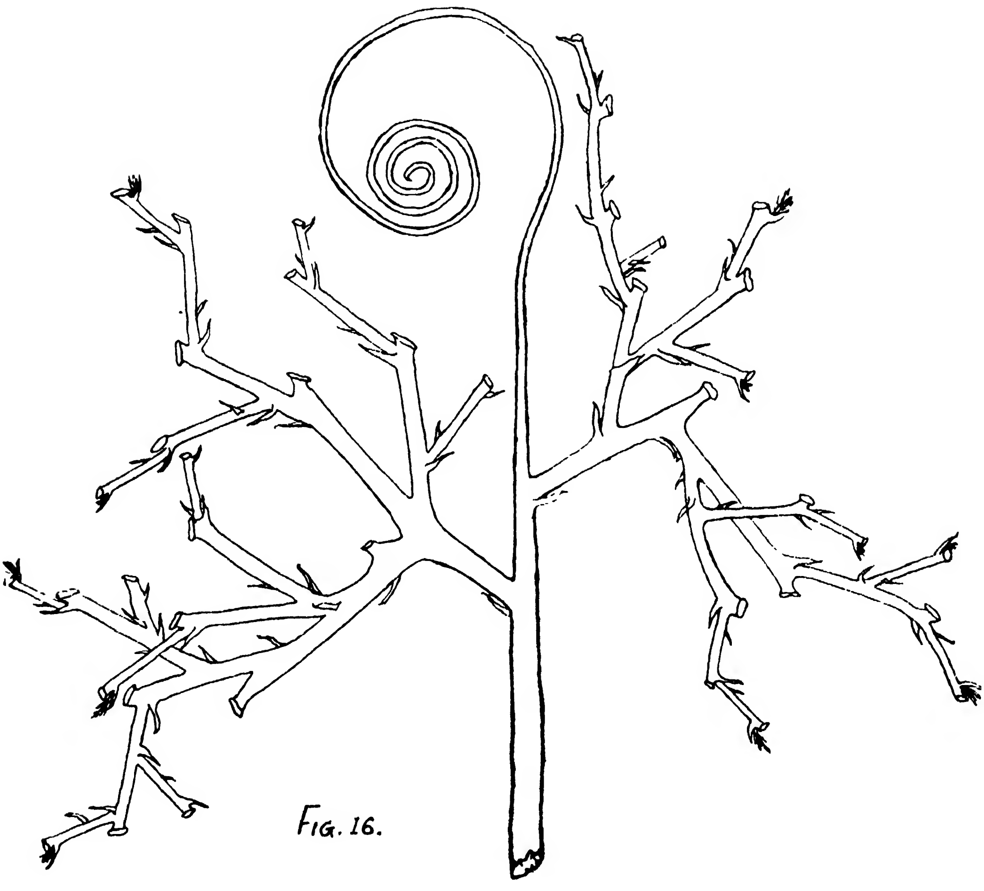


Fig. 16.—Inflorescence of *A. digitata* (Harv.) Engl., from Mogg 8182, [illegible]. Enlarged several times

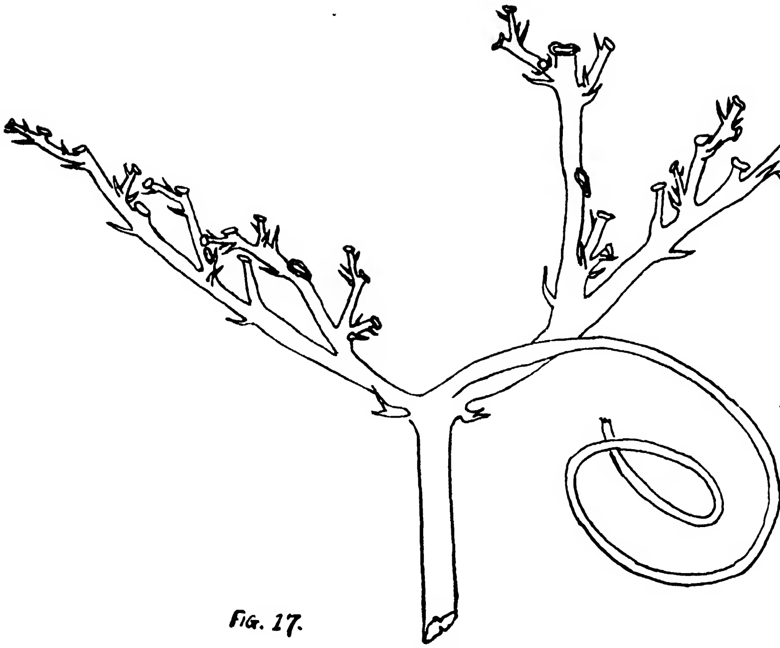


Fig. 17.—Inflorescence of *A. digitata* (Harv.) Engl., several times enlarged. From Osborne in Nat. Herb. 2639, ♂.

Natural Relationships and Classification of the South African Species.

Of the eight species which the writer distinguishes, six, to our present knowledge, are practically limited to South Africa. Under such conditions one would perhaps expect a certain degree of relationship among them and such appears to be the case. As already pointed out *glauca* and *spinosa* are closely related while *fruticosa* may be regarded as a near relative; *digitata*, and *Wilmsii* on the other hand, are even more closely related to each other. The writer regards the latter as having been evolved from the variable *digitata*.

Gummifera and *repanda* have (like *glauca* and *spinosa*) no glands and in addition they lack coronae and have simple leaves; *gummifera*, a widely distributed species in Africa, and *hastata* and *repanda* are not clearly related to each other or to any of the other species.

The classification of the majority of species presented little difficulty but, as a result of leaf heterophylly in one species, however, the work was much delayed, the complexity of the problem being increased by dioecism and floral polymorphism. The classification of the *senensis–digitata* material has resulted in more than 2 years delay in the completion of this study. Early in this work it became evident that leaf variability (heterophylly) within the *senensis–digitata* group has been responsible for the founding of a few additional species. To obtain the necessary proof for this view, has involved a good deal of time. This view is being illustrated by means of Plates 16–36 in conjunction with Plates 8–15 showing photos of type specimens of the species which were sunk. Moreover, further delay occurred when the South African material of *senensis–digitata* was forwarded to Kew for comparison, although, unfortunately, this procedure has been of little or no assistance.

Attention is here directed to the fact that amongst the material which the writer classifies under *A. digitata* a number of specimens have rather large fruits and may therefore represent a distinct group which appears to grow only in a certain area, approximately

defined by the Pretoria-Rustenburg districts. It is not unlikely that in future evidence may become available that would justify the separation of such large-fruited plants as a distinct variety (or perhaps species). However, such classification should be based on at least another character not associated with the fruit as otherwise male plants (and non-fruiting female plants) from the same area, cannot be satisfactorily classified or will have to be classified with the species. Even if at this stage one were to favour separation of large-fruited specimens as a distinct group (variety or species) such a procedure would be impossible on account of this very difficulty, because there is as yet no means of separating male or non-fruiting female plants. As a result of dioecism and floral polymorphism field studies would be necessary. Herbarium material is usually wanting in either fruit or flowers.

It should be mentioned that giant cells ("Gerbstoffbehälter") have not been observed on the Pretoria-Rustenburg specimens but, as pointed out, the distribution of this character is so variable and erratic that too much significance should perhaps not be attached thereto. Another character which would perhaps assist the elucidation of this problem is fruit colour.

A Note on *A. multiflora* Potts

This species was described from the growth made from an "enormous tuber" (61 cm. diameter and 30 cm. high) collected at Baviaanspoort, near Pretoria, by Dr. J. M. Fehrson in September, 1913. The description was based on material obtained from growth made "in a very sunny spot on the windowsill in the herbarium" (Transvaal Museum). The "tuber" was presumably not in soil and flowered first in February, 1914. "It never got a drop of water and again in October of the same year it made long shoots and flowered profusely as can be seen by the photograph taken at that time." Somewhat abnormal growth might be expected under such conditions and the present writer suggests that the numerous and small flowers as well as the unusually narrow lobed leaves (and the absence of tendrils too) that the "type" specimen showed was probably due to this or perhaps to the wrong season in which the plant first flowered. The multiflowered character is not unusual in *A. digitata.*

The "tuber" is stated to grow partly above ground and to have had a "grey leathery skin . . . green beneath". This character in itself was at first considered by the writer to be sufficiently distinct to justify a distinct species from *A. digitata* but on further study of photograph and type material in comparison with *A. digitata*, he observed a strong resemblance between the two and thereupon made another attempt to obtain material from the type locality, several previous visits having been unsuccessful. He was fortunate to locate two *Adenia* plants under a tree of *Acacia caffra.* They were growing side by side and their branches and leaves were dry but in the latter case both were of the *A. digitata* type. The two tubers were dug up and the one was completely underground and resembled a typical *A. digitata* tuber. The other one, partly above ground, was found to be growing immediately above a large root of the *Acacia* tree and had produced two separate "tap-roots" on either side of the root on which it was, so to speak, sitting astride, Plate 7. This obstruction possibly accounts for its appearance above the surface of the ground where the exposed surface was grayish but green just beneath, as described for *A. multiflora.*

The accompanying photograph shows the two "tubers". This, the writer contends proves that the appearance of the "tuber" above the surface of the ground is not due to a hereditary factor, but to environment. Whether subterranean obstruction is the only cause of this behaviour is doubtful for in the poisonous plant garden at the Onderstepoort Veterinary Research Laboratory, two plants of *A. digitata*, the tubers of which were originally "planted beneath the surface", have appeared above the surface and are said to be rising steadily.

ACKNOWLEDGMENTS.

The writer wishes to thank the Chief, Division of Plant Industry, Department of Agriculture and Forestry, for the facilities which enabled him to carry out this study. To Dr. E. P. Phillips, Principal Botanist, he is greatly indebted for interest and guidance.

Dr. H. G. Schweickerdt, Botanist for the Division of Plant Industry at Kew, has rendered valuable assistance in connection with the literature, the examination of type specimens both at Kew and Berlin, the examination and comparison with Kew material of some 100 sheets of the two closely-related species, *digitata* and *senensis*. He spared neither trouble nor time to obtain the desired information and I therefore make grateful acknowledgment to him.

My thanks are also due to the Curator of the Bolus Herbarium, the directors of the Capetown Museum, Albany Museum and Transvaal Museum, as well as to the Professor of Botany, Witwatersrand University and the Mycologist in Charge of the Natal Herbarium for the loan of specimens. Mr. W. G. Barnard, Stock Inspector in Sekukuniland has, on request, forwarded a range of very useful material for which I wish to thank him very much.

KEY TO THE IDENTIFICATION OF THE SPECIES.

1.	Plants with well-developed thorns ; leaves simple..................................	*A. spinosa.*
	Plants without thorns (rarely with weak thorns in *A. fruticosa* but then leaves lobed)	2
2.	Leaves simple or not digitately compound..................................	3
	Leaves digitately compound..................................	5
3.	Leaves at least 3 times as long as broad..................................	*A. repanda.*
	Leaves not more than 1·5 times as long as broad or leaves broader than long.......	4
7.	Leaves and flowers punctulate..................................	*A. gummifera.*
	Leaves and flowers not punctulate..................................	*A. hastata.*
5.	Leaves palmately 7-lobed (very rarely 5-lobed) tendrils absent....................	*A. Wilmsii.*
	Leaves palmately 3- to 5-lobed, tendrils present..................................	6
6.	Leaf-lobes more or less orbicular or somewhat broader than long; fruits variegated	*A. fruticosa.*
	Leaf-lobes at least twice as long as broad; fruits not variegated..................	7
7.	Leaf-lobes broadly elliptic or elliptic oblong very glaucous, entire, conduplicate; petals arising in sinuses of the lobes. "Tuber" always partly above ground...	*A. glauca.*
	Leaf-lobes lanceolate or lanceolate-ovate, not strikingly glaucous, not conduplicate; petals arising near the base of the calyx tube. "Tubers" very rarely above ground..................................	*A. digitata.*

DESCRIPTION OF THE SPECIES.

Where possible the sex of the specimen has been indicated as well as the herbarium in which the specimens may be found.

A.—Albany Museum Herbarium, Grahamstown.
B.—Bolus Herbarium. Capetown.
C.—Natal Herbarium, Durban.
N.—National Herbarium, Pretoria.
S.—South African Museum Herbarium, Capetown.
T.—Transvaal Museum Herbarium, Pretoria.
W.—Witwatersrand University Herbarium, Johannesburg.

All specimens quoted were seen by the writer.

1. **A. spinosa** Burtt Davy. Man. Fl. Pl. and Ferns. Pt. 1, 36, 221, 222.

Main (*swollen*) *axis*, irregular, tuberlike, variously shaped, fleshy, partly or mostly above ground, the latter green always growing in breadth, up to over 2 metres diameter (Bremekamp 3). *Branches*, numerous, " divaricate ", arising from attenuations of the main stem; branchlets virgate, striate, glabrous, armed with spines: spines terete spreading, fairly stout or slender, 1–3 cm. apart, 1·2 4 cm. long, glaucous, resembling the branches or brownish, or the cortex thickened towards the base or in patches or from near the base upwards, with a straight or curved point or ending in a short tendril, with or without " toothlike " prominences or inflorescences near or at the base. *Leaves* simple, entire, sessile or shortly petioled, 1·5–3·2 cm. long, 1–2·3 cm. broad; oblong-ovate, retuse or emarginate or rounded at the apex, cordate or rounded at the base: glands absent on surface, two glands at the apex of the petiole and another smaller one at the apex of midrib below; petiole subsessile to 7 mm. long; stipules minute, toothlike from a broad base, reddish brown. *Inflorescence* short or very reduced, in axils of the spines or clustered at the base of spines; " cymes " 1-few-flowered; peduncles usually very abbreviated, terminating in pedicels or spines. *Male flowers* about 1·8 cm. long, yellowish. *Receptacle* scarcely 3 mm. long. *Calyx-tube* obconical, one-third the length of the lobes; lobes spreading, linear-oblong, entire, obtuse. *Petals* about two-thirds as long as the calyx-lobes, arising from their sinuses but appearing to be also partly inserted on the tissue joining calyx-tube to the staminal-tube, membranous, transparent, 1-nerved, linear, acuminate, narrowing below, subserrate or subundulate near the apices. *Corona* of slender processes, 0·5–1·0 mm. long, arising around the bases of the petals, partly or largely from the tissues joining staminal-tube to calyx-tube. *Stamens* much overtopped by the petals, extending to the middel of the calyx-lobes; filaments connate for half their length at the base, adnate to the calyx-tube at 5 points, forming 5 shallow narrow pockets; anthers linear or oblong; connective not produced into a point. *Glands* O. *Ovary* rudimentary, small. *Female flowers* not seen. *Fruit* yellowish, about 2 cm. long, ovoid; pericarp leathery-papery, ? usually indehiscent.

TRANSVAAL.—Zoutpansberg district: Messina, September 1918, *Rogers* in T. 24000, ♀. Messina, *Rogers* 19299, ♀ (N). Messina 2,000 ft., September 1918, *Rogers* 21664, ♂ and ♀ (N). Messina, *Rogers* 19341, ♀ (N). Near Messina, base of kopjie above the river Limpopo near the gorge, shrub w. elephantsfootlike base 27.5.27, *Young* in Herb. Moss. 14672, ♂, and T. 26933. On farm " Zoutpan No. 193 ", very characteristic of northern slopes of Zoutpansberg, main stem tuberous, about 1 ft. high and 2½ ft. broad at the base, Novem. 1932, *Obermeyer*, *Schweickerdt* and *Verdoorn* 137 (N & T), 2 sheets of each. North of Fogwells, 21.12.35, *Smuts* and *Gillett* 3114 (N). Pietersburg district: At Naauwpoort, 29.1.31, *Bremekamp* and *Schweickerdt* 469, ♂ (N & T).

2. **A. repanda** (Burch.)* Engl. Bot. Jahrb. XIV 375.

Main axis a tuberlike topshaped—napiform root with a stem formed from accumulated remains of annual growths, subterranean ? or partly exposed. *Stem* woody, up to about 20 cm. high and 8 mm. thick, greyish brown. *Branches* straggling, ? or climbing, striate, grayish or purplish gray, glaucous, about 4 mm. thick at base, up to 120 cm. long, arising from the main stem or directly from the rootstock ; branchlets absent. *Leaves* subsessile or shortly petioled, semi-conduplicate, 6–13 cm. long, 0·5–2 cm. broad, simple, subentire, remotely repand or short-lobed, with thinly cartilagenous green or reddish margins ; linear-lanceolate or elongate-elliptic, obtuse, reticulated ; glands on underside of leaf, below each marginal inequality (or lobe), below the apex at the end of the midrib and 2 at base of leaf on each side of apex of the petiole ; petiole up to about 5 mm. long ; stipules brownish, acicular, 1–1·5 mm. long. *Inflorescence* usually small, axillary, characteristically 2- to few-flowered ; peduncle usually with alternate sidebranches, generally 1 sidebranch develops, occasionally both rudimentary ; peduncle ending in tendril or pedicel ; flowers usually dioecious,† "yellowish", "dirty yellow" or "ochraceous", or "greenish". *Male flowers* about 2 cm. long. *Receptacle* usually about 3–4 mm. long, narrowly cylindric, slightly widening upwards. *Calyx* obconically tubular, the limb half or slightly less the length of the tube ; lobes spreading, ovate to ovate-oblong to subovate to elliptic oblong, obtuse or subobtuse, entire. *Petals* inserted a little below the sinuses of the calyx-lobes or occasionally towards the middle of the calyx-tube, membranous, transparent, 1-nerved or with branched palmate veins, narrowly oblong or elliptic-oblong, acute to subobtuse, entire. *Corona* 0. *Stamens* free, inserted usually at about the middle of the calyx-tube, rarely lower, about equalling the petals in length ; filaments, subulate or linear-subulate, from half to as long as the length of the anthers ; anthers broadly linear ; connective not produced into a point. *Glands* 0. *Ovary* rudimentary, about 1 mm. in length. *Female flowers* "greenish", just over 1 cm. long. *Receptacle* 1–2 mm. long, shortly funnel-shaped or sub-cylindric. *Calyx* reddish or greenish, subcampanulate ; the limb slightly shorter than the tube ; lobes oblong-ovate, obtuse, entire. *Petals* inserted more than halfway up the tube, extending to the sinuses of the calyx-lobes, transparent, membranous, 1-nerved, short, oblong or elliptic-oblong, acute or subacute, apices curved outwards, entire. *Corona* 0. *Staminodes* free or connate at the extreme base, inserted at the base of the calyx, subulate or subulate-linear, with apices curved, hooked or tipped with abortive anthers. *Glands* 0. *Ovary* stipitate, ovoid or ellipsoid-ovoid, smooth ; style fairly long, 3-branched, with the branches widening, terminating in a fleshy-papillate surface forming the stigma ; ovules few, arising either in lower half or in upper half of the ovary. *Fruit* bright or coral red, roundish to ovoid, roundly and shallowly 3-lobed, about 1·5–3 cm. long, leathery, dehiscent, splitting into 3 (or 4 ?) valves ; seeds roundish-heartshaped, regularly pitted. *Paschanthus repandus* Burch. Trav. 1, 543. *Modecca paschanthus* Harv. Flora Cap. 11, p. 500. *Jäggia repanda* Schinz.‡ Verh. bot. Ver. Prov. Brand. 1888, 254. Fig. in Engl. Pflanzenwelt Afrikas IX. Bd. 111, Heft 2, 601. *Paschanthus Jäggii* Schinz.§

* The present writer is inclined to endorse the view of Schinz (l.c.) who thought that this species does not fit in well into *Adenia* as in several respects it differs from it, viz. absence of corona, hermaphroditism, non-connate stamens absence of glands and insertion of the stamens. However, no critical attitude is justified as the writer has only studied a a limited number of the species in the genus.

† Burchell described this species as having polygamous flowers. Schinz described *Jäggia*, which Harms places as synonymous with *Adenia*, as hermaphroditic, Harms gives for his sect. 1. *Paschanthus* (Burch.) Harms (*Jäggia*, Schinz): Flowers hermaphrodite, polygamous or dioecious. The present writer has not found polygamy or hermaphroditism of common occurrence.

‡ H. Schinz in Bull. Travaux de la Soc. Bot. Geneve XI (67) 1891 states, *P. repandus* Burch. (*Jäggia repanda* Schinz).

§ The publication in which this epithet appeared is not known. *Modecca repandu* Druce. Rep. Bot. Exch. Club, Brit. Isles 1916, 636, is given as a syn. in Kew Index, but the author has not seen this publication.

TRANSVAAL.—Zoutpansberg district: Vivo, 20.1.31, *Bremekamp* and *Schweickerdt* 206, ♂ (N & T). Near farm Chapudi between Zoutpan and Waterpoort, branches flexuous not climbing, leaves markedly glaucous, scattered specimens seen 26.11.32, *Obermeyer, Schweickerdt* and *Verdoorn* 246, ♀ (N & T). Botanical Reserve, Messina, 18.12.28, *Pole Evans* 2, ♀ (N), (2 sheets).

CAPE PROVINCE.—Barkly West district: At Motito, Febr. 1842, *Burchell* 2486/2, ♂, *type* (N). Windsorton 1150 M., Jan. 1910. *Marloth* 5840, ♂ & ⚥ (N). Prieska district: Without precise locality rocky hillsides, greedily eaten by stock, 26.11.28 and 3.12.35 *Bryant* 345, ♀ (N).

BECHUANALAND.—Near Kuruman, Ga Mhani Mts. 1350 M. Febr. 1886, *Marloth* 1092, ♂ (N), 2 specimens.

SOUTH WEST AFRICA.—Windhoek, Nov. 1924, *Rogers* 29798, ♂ & ♀ (N & S). Ditto, *Rogers* 29723 and 29784 (T & S). Great Karasberg, Narudas Süd, middle slopes, straggling among rocks fairly common, Dec. 1912/Jan. 1913, *Pearson* 8166, ♂ & ♀ (N, C, & S). Okahandja, niedrige Acacienbuschsteppe, 27.1.07, *Dinter* 362, ♀ (S). Windhoek, Glimmerschieferberge, Dec. 1912, *Dinter* 4516, ♀. Waterberg: Quickborn, under thorn trees, Apr. 1929, *Bradfield* 75, ♀ (N). Near Karibib, 24.12.29, *Moss* 17893, ♀ (W). hills S.W. Gründoorn, erect 2-3 ft., in partial shade, *Pearson* 4276 (N).

3. **A. gummifera** (Harv.) Harms. Natürl. Pflanzenfam. Nachtrag 1, 255.*

Main stem woody, cylindric, greyish, up to 7·5 cm. in diam., the nodes enlarging with age, climbing to tops of large forest trees ("liana"), profusely branched. *Branches* green, striate, climbing in the canopies of trees, very glaucous; branchlets often numerous. *Leaves* petioled, 4·3–10 cm. wide and 4–8·8 cm. long, varying from kidney-shaped to deeply 3-lobed: lobes usually shallow, rounded, entire, the median one oblong, triangular or broadly oblong-ovate, bases variously cordate, subtruncate or variously rounded; sinuses wide; undersurface paler, visibly net-veined, punctulate (gland dotted) on one or both surfaces: dots dense or scattered, same colour as leaf surface or black; glands, ? rarely present on under surface of leaf, solitary at the apex of the petiole: petiole 3·5–9 cm. long; stipules minute, scale-like or a scaly ridge, usually shrivelling away with age. *Inflorescence* usually fairly open (not reduced), 2-many-flowered; sidebranches of peduncle usually alternate, sometimes one or both undeveloped: peduncles of primary inflorescences 2-14 cm. long, usually terminating in a tendril, sometimes in a long pedicel; flowers "green" "cream", "yellowish". *Male flowers* about 1·5 cm. long. *Receptacle* 3-5 mm. long, narrowly subcylindric, abruptly widening at upper end or subfunnel-shaped or obconical. *Calyx-tube* under 2·5 mm. long, saucer-shaped or ring-shaped, one-third to one-fifth the length of the limb; lobes spreading, linear or narrowly oblong-ovate or oblong-elliptic or linear-ovate or oblong or subspathulate, obtuse to subacute, entire or slightly uneven at apices, faintly striped-splashed and remotely black-dotted (punctulate). *Petals* inserted at the sinsuses of the calyx-tubes, resembling these and equalling them in length, or shorter or slightly longer, linear-oblanceolate, subspathulate, oblanceolate or linear or elliptic-oblong, more transparent and less punctulate than the calyx-lobes, crenate-dentate, uneven near the apices, acute to obtuse. *Corona* 0. *Stamens* arising from the centre of the receptacle, extending to beyond the middle of the calyx-lobes or nearly to their apices; free portions of filaments shortly subulate or linear-subulate, connate for almost half (or slightly more)

* There is apparently a good deal of confusion as regards the relation between this species and *A. cissampeloides* (Planch) Harms, some regarding them as identical. Masters divides them, it would appear, as an Eastern and Western species and describes both as having the sepals inserted at the base of the calyx which definitely is not the case in the S.A. plant which invariably has the petals arising in the sinuses of the calyx-lobes and correctly described by Harvey in Fl. Cap. vol. 2, p. 500. Dr. H. G. Schweickerdt writing from Kew (Jan. 6, 1937) states: "*A. gummifera* (Harv.) Harms and *A. cissampeloides* (Planch) Harms are two good distinct species. I first believed them to be conspecific, but now am quite convinced that they are distinct; the venation differs."

their length at the base or almost free ; anthers, linear, or linear-oblong, densely and minutely reddish-brown spotted; connective ? usually "dotted" (punctulate). *Glands* 0. *Ovary* rudimentary, minute or overtopping the staminal tube. *Female flowers* about 5–6 mm. long or slightly longer. *Receptacle* minute, 1 mm. and under. *Calyx-tube* absent or practically so ; sepals spreading, linear-oblong, ovate or ovate-oblong, faintly-striped-splashed and remotely black-dotted (punctulate), obtuse to subacute, entire. *Petals* inserted at the sinuses of the sepals, about half the length of these or shorter, linear, under ½ mm. wide, apices curved, transparent, with black "dots" few or absent. *Corona* 0. *Staminodes* short flat out-growths or toothlike, arising just at the base of the ovary stalk. *Glands* 0. *Ovary* sessile, or shortly stipitate, ovoid, smooth ; style short or wanting ; stigma of short reflexed lobes, arising abruptly from the narrowed apex of the ovary or as 3 expanded branches from a short style ; ovules, several. *Fruit* "brownish-orange", up to 4 or 5 cm. long, ellipsoid, leathery, dehiscent, seed 4 mm. long somewhat flattened, subovate, regularly pitted. *Modecca gummifera* (Harv.) Harv. & Sond. Fl. Cap. II, 500. *Ophiocolon* (*M.* ? *gummifera*) Harv Gen. S. Afr. Pl. Ed. 2, 121. *Ophiocolon gummifer* Mast. Oliv. Fl. Trop. Afr., II, 518. *Ophiocolon gummifera* (Harv. & Sond.) Mast. Nat. Pflanzenfam. Ed. I, III, ta., 83. *Adenia gummifera* Burtt Davy Fl. Pl. and Ferns, Tvl., & Swaz. 1, 222, and in Ann. Transvaal Museum III, 121.

TRANSVAAL.—Nelspruit district: At Kaapmuiden, Febr. 1923, *Thorncroft* 1199, in T.M. No. 23140, ♂ (T). Just outside Nelspruit, 2,700 ft. 26.10.30, *Liebenberg* 2636, ♂ (N). Barberton district: Highland Creek, climbing over trees 10–20 ft. high, 4,000 ft, 29.1.90, *Galpin* 782. Zoutpansberg district: Farm "Elsteg", 5 miles west of Louis Trichardt, Nov. 1932, *Obermeyer*, *Schweickerdt* and *Verdoorn* 355, ♀ (N & T). At Elim, Dec. 1930, *Obermeyer* 819, ♀ (T). Pisangkop, Febr. 1878, *Nelson* in T. 11159, ♀. Pietersburg district: Modjadjies, *Rogers* 18110 (W). Politsi, Dec. 1932, *Schweickerdt* 1039, ♂ (N). Tshakoma, Nov. 1931, *Obermeyer* 1063 (T). Magoebaskloof, Jan. 1933, *Murray* 761 (N). Lydenburg district: Mariepskop, Nov. 1925, *Fitzsimons* and *van Dam* in T. 30631, ♂. Sekukuni Location, Kloof, Western Spur on farm Magnets Heights 4,500 ft., 24.10.34, *Barnard* 128, ♂ (N).

NATAL AND ZULULAND.—Durban, Doonside, Dec. 1933, *Wyllie* in C. 23313, ♂. Berea, 150 ft., Dec. 1894, *Wood* 5502, ♂ (N). Ditto, 17.1.98, *Wood* 6662, ♂ & ♀ (N). Farm Friedenau, Station Dumisa, 6.12.08, *Rudatis* 523, ♂. Without precise locality, *Gerrard* and *McKen* in C. 688, ♂. Pietermaritzburg: Umlalaas, 1.1.33, *Gerstner* in C. 22614.

CAPE PROVINCE.—In woods near Keimouth, 100 ft., Jan. 1892, *Flanagan* 1156, ♂ & ♀ (N). Port St. John, climbing over shrubs, 15 ft., Dec. 1896, *Galpin* 3461, ♀ (N). Umtata to Port St. Johns, Dec. 1927, *Blenkiron* in W. 16053. Kentani district: Valley, immense climbing plant, Jan. 1903, alt. O, *Pegler* 869, ♂ (N).

4. **A. hastata** (Harv.) Schinz. Bot. Jahrb. XV. Beibl. 33, 3.

Root not known ? like in *A. digitata*. *Main stem* ? absent. *Main branches* herbaceous, annual straggling, procumbent or climbing, striate, greyish or dark, sometimes glaucous, up to 4 mm. thick at the base and "250 cm. long or more", ? arising from an underground ? tuberlike rootstock ; branchlets usually absent. *Leaves* petioled, 3–8 cm. long and broad, simple, entire, variously cordate-ovate to hastate* (but the lateral lobes obtuse) with the median lobe lanceolate, acute or subobtuse ; glands 2 (paired) at the apex of the petiole, variable, often 2 (paired) at the leaf apex, variable ; petiole, 0·8–5·0 cm. long ; stipules subulate and toothlike, 1·5–2·0 mm. long. *Inflorescence* axillary, varying much in size ; peduncles usually terminating in tendrils, with sidebranches usually opposite and few-flowered. *Male flowers* 1·3–3·1 cm. long. *Receptacle* 3–8 mm. long, subcylindric, widening towards the apex, or obconical to subfunnel-shaped. *Calyx* tubular, widening upwards or

* Peltate-ovate leaves were typical of *Gerstner* 2345 but were not observed in any other specimens.

subcampanulate, with the limb one-third to one-half the length of the tube; lobes ovate to orbicular or oblong, obtuse or subacute, with the 5 interiorly overlapping margins laciniate-lacerate and the remaining 5 entire. *Petals* inserted below (just above the corona) at, or above the middle of the calyx-tube, transparent to subtransparent, 1-nerved or 3-veined, linear-lanceolate, narrowed at the base, entire to remotely serrate (or distantly narrow-lobed) or subentire or fimbriate-laciniate (filiform processes) for two-thirds or more of their length, with the processes varying in length and density. *Corona* a sinuate circle of filiform processes, arising from a little above the base of the calyx-tube in groups or in a continuous circle; processes 0·75–3 mm. long, scattered to very dense. *Stamens* arising from the centre of the receptacle extending to the sinuses of the lobes or well below; free portions of the filaments subulate-linear; connate for one-fourth to two-fifths their length at the base, forming a shallow cup adnate to the calyx-tube (at 5 points) forming 5 narrow pockets or depressions; anthers linear-oblong to linear, with the connective not produced into a point, equalling or up to 1·5 times the length of the free filaments. *Glands* 5, arising from the base of the pockets (or depressions), approximately 1·5 mm. long, hidden in or protruding from the pockets, flattened, capitate or subcapitate, shortly linear to shortly oblong or spathulate. *Ovary* subterete, protruding slightly above the staminal cup or extending beyond the apices of the filaments. *Female flowers*, 1·2–1·8 cm. long, " white " ?. *Receptacle* 1·5–2·5 mm. long, stout, shortly funnel-shaped or sub-funnel-shaped. *Calyx* campanulate or nearly so, narrowed at the base; tube twice as long as the limb; lobes ovate to orbicular-ovate to oblong-ovate, obtuse to subacute with the 5 interiorly overlapping margins laciniate to lacerate, the remaining entire. *Petals* inserted at about the middle of (or just below) the calyx-tube, extending to about the sinuses of the calyx-lobes, narrowly linear-acute or linear-acuminate, slightly curved at the apices or straight, entire or remotely dentate, narrowly lobed in the upper half. *Corona* a circle of filiform processes or fimbriately lobed processes; processes 0·75–1·75 mm. long, arising from near the base of the calyx-tube. *Staminodes* arising from the centre of the receptacle, bases connate, forming a collar around the stalk or ovary, adnate to the extreme base of the calyx-tube (? or receptacle) forming 5 pockets or depressions, linear-subulate, curved or bent near the apices. *Glands* arising from the side of the depressions very small or up to 1 mm. long, flattened, variously capitate, shortly oblong or subpathulate. *Ovary* stipitate, ovoid or spherical, smooth; style fairly long, 3-branched; branches palmately widened, terminating in a fleshy-papillate surface (stigma): ovules numerous. *Fruit* " as large as an egg " (Harvey), and smaller, " green and white ", roundish " pulpy ", leathery, ? dehiscent; seed flattened, ovate-orbicular, pitted. *Modecca hastata* Harv. Thes., Cap. 11, 43, pl. 167. *Adenia Schlechteri* Harms Engl. Bot. Jahrb. 33, 150. *Adenia hastata* Burtt Davy Ann. Transv. Museum III, 121.

TRANSVAAL.—Nelspruit district: Komatipoort, *Rogers* (? 12606) in T. 13273. Ditto, Nov. 1931, 1,000–2,000 ft., *Rogers* 12606, ♂ (S, B & N). Komatipoort, 14.12.97, *Schlechter* 11747 (N). Nelspruit, Dec. 1917, *Breyer*, T. 17956, ♂. Karino, 28.1.29, *Hutt* in N. 7870, ♀ Near Nelspruit, 24.1.06, *Cronje* in N. 1489, ♀. Barberton district: Barberton, Nov. 1915, *Rogers* 18369, ♂ (S). Barberton, Nov. 1931, *Smith* 7006, ♂ (N). Barberton, Sept./Oct. 1889, 2,300–3,000 ft. procumbent, 3–4 ft. long, in stonyground on hillsides among rocks, *Galpin* 563, ♂ & ♀ (B. & N). Hills near Barberton, climber, 3,000 ft., Aug. 1923, *Thorncroft* 2034, ♂ (N). Barberton, Oct. 1922, *Wager* in T. 23675, ♂. Barberton, Nov. 1931. *Smith* 7069 (N). Ditto, *Thorncroft* in C. 5980, ♂ & ♀. Ditto, Nov. 1909, *Williams* in T. 7643, ♀. Ditto, Oct. 1907, *Thorncroft* in T. 3923, ♀. Kruger National Park: Skukuza, in shade of *Acacia*, among rocks on N. bank of Sabi R., *Letty* 43, ♀ (N). ? district: Witsteen, growing in Div. Pl. Ind. Garden, *Hutchinson*, ♂ (N).

NATAL.—Without precise locality (? near Greytown), 29.10.31, *Pole Evans* 3836, ♀ (N). Nongoma district: Mahlabatini, between diabase, 18.11.37, *Gerstner* 2345, ♂ (N). Middle Umkuzi, on Mr. Nagels farm, 10.1.36, *Gerstner* 2895 (N).

5. **Adenia Wilmsii** Harms. Engl. Bot. Jahrb. 26 : 238.

Root tuberlike, napiform or variously shaped, ? not rising above ground, up to 7 lbs. ? and over. *Main stem* ? always underground, an attenuated outgrowth from root or ? formed from accumulated remains of annual growths, woody. *Branches* herbaceous, annual. one or more from same rootstock or main stem, semi-erect or semi-procumbent up to 50 cm. and over. *Leaves* digitately compound, petioled ; lobes 7, occasionally 5, the median lobe often entire, but usually pinnati-lobed (1–2 pairs) at about the middle or below, 5-12 cm. long (? often less) ; the other lobes entire and simple, unequal in length ; glands absent on under-surface and usually also in the sinuses of the lobes ; petiole stout, usually long, 4–7 cm., with 2 large (occasionally 4) fleshy circular glands at the junction with the lobes, above ; stipules about 1·2 mm. long, toothlike. *Inflorescence* axillary ; peduncle stout, 4–5 cm. long, terminating in a normal flower ; main branches opposite or alternate, one or both sometimes rudimentary with the " terminal " flower (at the termination of the peduncle) ? always developed ; peduncle branches of normal stems 1-flowered, 2- to 3-flowered on reproductive shoots ; flowers yellowish. *Male flowers* about 2·5 cm. long. *Receptacle* 5-7 mm. long, linear, subcylindric widening upwards. *Calyx* salver-shaped or cylindric-campanulate ; tube cylindric or narrowly obconical, sometimes abruptly narrowed above the base, one and one-half to twice the length of lobes ; lobes ovate or oblong-ovate or subelliptic, obtuse or subobtuse, interior margins entire or subentire. *Petals* inserted a little below the middle of the calyx-tube, extending a little or well beyond the sinuses of the lobes, membranous, transparent, palmately 3- or 5-veined, with sideveins in the latter usually few-branched, oblanceolate or elliptic-oblanceolate, subserrate in upper ½ or ⅓, subobtuse. *Corona* of slender processes, 0·5–0·75 mm. long, arranged in a circle or sinuate ring just below the insertion of the petals. *Stamens* well overtopped by the petals, extending to just below the sinuses of the calyx-lobes, connate for half their length at the base ; filamental column adnate to the calyx-tube for ½ or its full length producing 5 pockets ; anthers equal in length or longer than the free filaments, apiculate. *Glands* arising from the base of the pockets, flattened, capitate : stems short or almost absent. *Ovary* rudimentary, extending half way up the filamental column or its entire length. *Female flowers* not seen.

TRANSVAAL.—Lydenburg district : On High School grounds in Lydenburg, Oct./Nov. 1935, *Van Wyk*, ♂ & ♀ (N). Without precise date and locality (? at Lydenburg), *van Wyk* (N). Lydenburg, 1935, *Pons*, ♂ (N). Farm Rooidraai,1/8" long stems, red loam soil, 7.12.35, *Liebenberg* 3488 (N). Ditto, *Liebenberg* 3496 (N).

6. **A. fruticosa** Burtt Davy Man. Fl. P. & Ferns Tvl. & Swaz. 1, 36.

Main (swollen) axis tuberlike, flask-shaped, trunklike, fleshy, smooth, partly or mostly above ground, the latter green, up to over 2 metres, branched or unbranched at the base, ending in whiplike branches (Bremekamp). *Branches* climbing, striate, greyish-green, glaucous ; branchlets present in axils of tendrils. *Leaves* compound, digitately 3-lobed, rarely 5-lobed, petioled ; lobes petioluled to subsessile, the median about 1·7–6·5 cm. long and about the same width, the lateral and basal smaller, simple, entire, rotund, orbicular or orbicular-obovate, subtruncate, retuse or rounded at the apex ; glands absent on all parts of the leaf including the sinuses of the lobes (? always) with 1 large subreniform subpeltate gland at the apex of the petiole ; petiole 1–5·0 cm. long ; stipules, minute, toothlike, ½ mm. or less long ; tendrils sometimes strong or weak, sometimes breaking off giving the appearance of thorns. *Inflorescence* usually on axillary branchlets, in axils of leaves or tendrils, 1- to 3-flowered, usually alternate, sometimes one or both rudimentary ; peduncle wanting to 4 mm. long, terminating in a flower not a tendril ; tendrils without developed cymes, in axils of leaves, with or without bracts. *Male flowers* not seen, according to Burtt Davy : *Sepals* imbricate (in bud about 8 mm. long). *Petals* free, membranaceous (about 1 cm. long and 2·5 mm. wide). *Stamens* 5-6, free ; filaments 2 mm. long ; anthers about

2·5 mm. long, laterally dehiscent. *Ovary* rudimentary, small. *Female flowers* " greenish ", yellowish or " yellowish-green ", about 8 mm. long *Receptacle* subcylindric, 1 mm. long. *Calyx* subcampanulate; lobes semi-erect, 3–4 times as long as the tube, elliptic-oblong, obtuse, entire, with broad green longitudinal veins. *Petals* about ½ the length of the calyx lobes or slightly longer, arising from the sinuses of the latter but appearing also to be partly inserted on the tissue joining calyx-tube to staminal column, membranous, transparent, with 1 broad green vein, ovate-lanceolate, tapering towards the base in lower third, serrate-uneven in upper half. *Corona* a circular lacerated fringe with slender-branched filiform processes about 0·5 mm. long arising from the edge of the calyx-tube and from the tissue joining staminal tube to calyx-tube. *Staminodes* connate for half their length at the base, forming a column around the base of the ovary stalk; staminal column joined to the calyx-tube at 5 points by means of fleshy membranous tissue, forming 5 pockets with the free ends subulate and apices curved. *Glands* broad, flattened, arising at the base of the " pockets ". *Ovary* stipitate, spherical, smooth; style short, 3-branched; branches long, terminating in shield-like fleshy-papillate structures forming the stigma; ovules few. *Fruit* yellowish, longitudinally unevenly banded with green, approximately 2 cm. long, roundish, leathery, dehiscent, splitting into 3 valves; seeds flat, suborbicular, regularly pitted. Bremekamp in Vegetationsbilder 1932: 23, 3, pl. 18.

TRANSVAAL.—Pietersburg district: On slopes 2 miles beyond Chuniespoort Hotel, pale green succulent flask-shaped, stems up to 1 5 ft. high, lounging against *Peltophorum*, several branches ascending and climbing in the tree, May 1935, *Obermeyer* and *Verdoorn* 10 (N & T). M'Phatlele's Location, climbing plant with swollen stem, 9.10.19, *Pole Evans* in N. 19885, ♀. Zoutpansberg district: Dongola Reserve, Messina, 15.9.34, *Pole Evans* 3747, ♀ (N). Lydenburg district: Sekukuni, farm Driekop, dry sandy loam, 3,500 ft., 17.12.36, *Barnard* 454B (N). Ditto, between crevices on " koppies ", bole attains size of a 56-gal. barrel, 4 ft. high, 13.1.36, *Barnard* 454 (N).

7. **A. glauca** Schinz Bot. Jahrb. XV. Beibl. 33 Heft 1, 1–3.

Main (*swollen*) *axis* tuberlike, " urn-shaped " or irregular-shaped, fleshy, partly or, mostly above ground, the latter greyish, green beneath the skin, of various shapes and* sizes, up to 2 ft. (or more ?) high. *Branches* ? divaricate, striate, glaucous, up to 5 mm. thick and about 150 cm. long, arising from attenuations of the main stem or directly from a flat surface; branchlets ? usually few or absent, rarely well developed, resembling the branches but greener, glaucous. *Leaves* digitately compound, petioled; lobes 5, occasionally sub-petioluled, conduplicate, 1·5 6 cm. long, entire, with the margins thinly cartilagenous, elliptic, sub-orbicular, rotund or obovate, gradually or abruptly narrowed at the base, obtuse; glands absent on all parts of the leaf including sinuses of lobes, with 2-paired flaplike glands† at the base of the leaf; petiole 0·6 5 cm. long; stipules minute, toothlike, dark reddish-brown. *Inflorescence* usually axillary, peduncles opposite or alternate with 1- to 2-flowered sidebranches, occasionally many-flowered; peduncles usually terminating in tendrils, not infrequently in shorter or longer flower-bearing pedicels. *Male flowers* yellowish, about 3 cm. long. *Receptacle* 1·1–3·5 cm. long, usually about 1 cm. long, linear-subcylindric, gradually widening towards the apex. *Calyx-tube* obconical or subobconical, ⅓–⅙ the length of the lobes; lobes semi-spreading, linear-oblong, sometimes broadening towards the apex to linear, or elliptic-oblong, obtuse or subobtuse, entire. *Petals* more than half the length of the calyx-lobes, arising from the sinuses of the calyx-lobes but appearing also to be partly inserted on the tissue joining staminal cup (tube) to calyx-tube, membranous, transparent, 1-nerved or palmately 3-veined, the median vein unbranched or remotely branched or branches absent with occasional stray veins, narrowly oblong-elliptic or linear-lanceolate tapering towards the base or ovate-lanceolate or lanceolate at both ends, acute to obtuse with curved or straight apices and margins remotely or unevenly

* Sometimes with " neckline " protuberances from which the branches arise. (Smith 6271.)

† Schinz (l.c.) refers to 1, 2 or 3 glands " oberhalb der Achselprodukt " but the writer has found only bracts enveloping a bud.

serrate or dentate in the upper third or two-thirds. *Corona* of a few filiform processes, about 0·5 mm. long (very rarely 1·5 mm. long), arising from around the base of the petals partly or entirely from the edge of the tissue joining staminal cup to calyx-tube. *Stamens* much overtopped by the petals, extending about half way up the calyx-lobes, free portions of filaments subulate or linear-subulate, of varying length, connective produced into a point, connate for half to two-thirds their length at the base forming an obconical cup adnate to the calyx-tube at 5 points producing 5 narrow pockets; anthers short, broad, or linear oblong, equalling the free filaments in length or occasionally up to 4 or 5 times their length. *Glands* 0. *Ovary* rudimentary, 2 mm. long. *Female flowers* yellowish, about 1·4 cm. long. *Receptacle* approximately 2·4 mm. long, shortly funnel-shaped or narrowly subcylindric. *Calyx-tube* subcylindric to cup-shaped, one-third to one-fifth the length of the lobes; lobes semi-spreading or subspathulate or obovate or oblong or linear, elliptic-oblong, obtuse to sub-obtuse, entire. *Petals* about half the length of the calyx-lobes, arising from the sinuses of the latter but appearing also to be partly inserted on the tissue joining calyx-tube to staminal tube, membranous, transparent, 1-veined, with sometimes remote branches or an occasional stray vein, oblanceolate to linear-elliptic to lanceolate in upper one-third to one-half, gradually tapering towards the base, acute to truncate-toothed, with curved or straight apices and margins subentire or remotely serrate-uneven in upper parts. *Corona* of a few filiform processes about 5 mm. long, arising from around the base of the petals, partly or entirely from the edge of the tissue joining staminal tube (cup) to calyx tube. *Staminodes* connate for half or more of their length at the base to form a wide tube or collar around the ovary stalk; adnate to the calyx-tube at 5 points forming 5 narrow pockets with the free filaments subulate-tapering, sharply curved at the apices or with rudimentary anthers. *Glands* 0. *Ovary* stipitate, ovoid to orbicular, or rarely somewhat 4-sided, smooth or with transverse raised bands; style short, 3-branched, * the branches widening upwards terminating in a papillate-fleshy stigma; ovules ? few. *Fruit* ? orange to yellow-coloured, roundish to ovoid, roundly and shallowly 3 (–4) lobed, leathery, ? usually dehiscent, splitting into 3 (4) valves. *Seeds* flat, roundish-heartshaped, regularly pitted. *Modecca glauca*, Schinz. Bot. Jahrb. XV. Beiblatt 33, I.

TRANSVAAL.—Waterberg district: Warmbaths, 8.12.04, *Burtt Davy* 2622, ♀ (N & B). Near Pienaars River, 52 miles west of Warmbaths on hills, Sept. 1932, *Smuts* 355, ♀ (N). Vierentwintig Riviere, Jan. 1920, *Rogers* in T. 20816. Vygeboompoort, Sept. 1913, *van Dam* in T. 13191. Ditto. Oct. 1913, in T. 13715, ♀. Farm Roodepoort No. 15, Palala Rd., rocky ridge, large epigeal tuber with 18″ stems, 6.12.31, *Galpin* 11606, ♀ (N & B). Farm Doornfontein No. 1807, amongst felsite rocks, fleshy stem 1½ ft. high and 6″ diameter, 19.2.24, *Galpin* 9164 (N). Olifants Poort, 9 miles N.E. of Nylstroom, climbing up stem, of trees, on hillside, 6.12.34, *Galpin* 13195 (N).† Potgietersrust district: Farm Nooitgedacht near Naboomspruit, amongst rocks on mountain top, stems trailing from large epigeal tuber, 18.10.31, *Galpin* 11605, ♀ (N). Potgietersrust, June 1916, *Rogers* 18827, ♂ (N & B). Kwarriehoek School, everywhere, particularly between rocks and extended rock outcrops, *Steyn* 37, ♂ (N). On Temby Downs, epigeal portion of tuber conical 15″ high, malachite green, stems slender climbing 10 ft. up tree stems, 2,900 ft, 18.11.34, *Galpin* 13197, ♀ (N). Pretoria district: On summit of Daspoort range near Fairy Glen, 4,700 ft., 6.10.33, *Mogg* 14130, ♂ (N). Wonderboom, Mar. 1924, *van Dam* in T. 25042. Premier Mine, Aug. 1924, *Verdoorn* (N). Ditto, Dec. 1919, *Rogers* 25027 (T). Ditto, 4,000 ft., *Menzies*. Flats beyond Silverton, 12.10.19, *Phillips* 3021, ♀ (N). Derdepoort, 7.10.28, *Mogg* 15386, ♂ & ♀ (N). Magaliesberg, May 1920, *Marloth* 9508, ♂ (N). Foot of Magaliesberg on farm "Grafheim", 4 miles west of Wonderboom Poort, growing on rocky but loose

* In Smuts 355 there were 4 style branches and 4 placentae on the flowers examined.

† On farm "Grafenheim" along lower N. slopes of the Magaliesberg growing under *Ehretia rigida* bush in shady places and widely climbing among the branches of its support, rootstock a large tuber of globose to obovoid shape and partly buried in the loose black sandy soil . . . the exposed part often acquiring a highly polished surface, being thus very shiny and green . . . "vern. name 'Bobbejaan'", Oct. 1933, *Smith* 6841 ♂ (N).

sandy soil, stems up to 4 ft. with 2 or 3 necklike protuberances from which the stems arise, up to 50 lb. in weight, stems sprawling over other plants such as *Ochna pulchra* and *Burkea africana*, 31.7.32 C., 4,200 ft., *Smith* 6271, ♂ (N).* Without precise locality, growing in Stellenbosch University Garden, Oct. 1928, *Marloth* in N. 16416, ♀. Ditto, Div. Pl. Ind. Gardens, *Verdoorn* (N). Ditto, from Onderstepoort poisonous plant garden, Nov. 1934, *Liebenberg* 3222, ♀ (N). Ditto, 1932, *Steyn* A8; 9.11.32.

8. **Adenia digitata** (Harv.) Engl. Bot. Jahrb. XIV. 375.

Root tuberlike, subnapiform or variously shaped, appearing above ground (green) with subterranean obstruction, up to about 30 lb. ? and over. *Main stem* usually underground, from accumulated remains of annual growths, usually under 20 cm. long, and 15·0 mm. thick, woody. *Branches* herbaceous, annual, striate, climbing, up to 180 cms. long and ? more, and about 6·0 mm. thick, usually arising singly from a tuber. *Leaves* digitately compound, petioled; lobes usually 5, occasionally 3, (sub) or pinnatilobed or pinnatisect sometimes petioluled or simple, narrowly linear or linear lanceolate or ovate or elliptic-lanceolate, entire, unequal in length; central lobes 2·0 (? 1·5†)–16 cm. long; glands on lower surface circular or slightly oblong, usually present at all sinuses of primary lobes and of the lowermost secondary lobes of the primary central lobe, sometimes present at all sinuses of lower secondary lobes, occasionally absent in some of the sinuses of primary lobes or on the lower surfaces of simple lobes; petiole 0·5–7·5 cm. long with 2 paired glands above, at the apex; stipules minute toothlike, rarely up to 3 mm. *Inflorescence* axillary, two primary branches opposite or alternate, often 1-few-flowered, usually 4–8 flowered, rarely many flowered (18–20‡); peduncles absent or almost so, to 6·5 cms. long, always ending in tendrils; flowers whitish, bright-greenish, pink tinted or creamy or yellowish. *Male flowers* 1·5–3·5 cm. long. *Receptacle* 3–9·5 mm. long, linear- subcylindric, widening upwards or funnelshaped. *Calyx* subcampanulate or campanulate; tube subcylindric widening upwards or obconical sometimes with a slight constriction just above the base, equal in length to the lobes or up to 3 times their length; lobes elliptic-ovate or oblong-ovate or broadly ovate (or-bicular-ovate) or oblong ovate; obtuse to subacute, interior margins lacerate-laciniate, very rarely entire or subentire. *Petals* inserted near the base of the calyx tube, rarely near the middle thereof, extending to the sinuses of the calyx lobes or a little below or well above; membranous, transparent, palmately 3-veined with the sideveins entire or few-branched; oblanceolate- acuminate, oblanceolate or linear-oblanceolate or broadly oblanceolate or elliptic-ovate with narrowed bases or lanceolate in upper half, cuneate-tapering in lower half; acute to obtuse, upper ⅔ or ⅓ serrate or serrulate or denticulate (dentate)—laciniate or serrate-denticulate, rarely entire or subentire. *Corona* sometimes absent or nearly so, of slender processes 0·5–0·75 mm. long, rarely over 1 mm.; arising in a continuous sinuate ring rarely in groups from between the bases of the petals, sometimes subpapillate at the upper ends. *Stamens* usually overtopped by the calyx tube and petals, extending below or beyond the sinuses of the calyx lobes, connate for half their length, rarely up to ⅔ their length; the filamental column adnate to the calyx tube in its lower half very rarely only at the base or for its full length, producing 5 pockets; anthers shorter or longer than the filaments, apiculate, loosely adhering at these points. *Glands* usually about 0·5–0·75 mm. long, arising from the base of the "pockets", flattened, capitate, variously shaped. *Female flowers* 1·5–2·5 cm. long. *Receptacle* 2–6·5 mm. long, subcylindric widening upwards or funnelshaped, sometimes also widened at the base. *Calyx* campanulate; tube obconical or subcylindric widening upwards, as long as the lobes or up to double their length; lobes ovate or broadly oblong-ovate, or narrowly oblong or

* Without precise locality, Waterberg dist. vine w. large thick tuberous rootstock, 9.11.28. *Repton* 96 ♀ (N).

† Some flowering specimens have central lobes 1·5 cm. long, though it is not known whether they are full-grown. In the Fehrson specimens (type of *A. multiflora* Pott.) the leaves are much shorter.

‡ In *Eyles* 3243 in Herb. Bolus (from Rhodesia), Fig. 15, the inflorescence is approximately 40-flowered.

broadly lanceolate, acute to obtuse with interior margins entire, very rarely subentire. *Petals* inserted near the middle or near the base of the calyx tube, extending to the sinuses of the lobes or below or above; membranous, transparent, 1 veined, very rarely 3-veined, oblanceolate or lanceolate to ovate-lanceolate in upper $\frac{1}{2}$ with lower $\frac{1}{2}$ gradually tapering towards the base, linear-lanceolate, narrowed at the base, or linear-oblanceolate or narrowly elliptic, entire, sometimes remotely toothed towards the apices, very rarely laciniate in upper $\frac{1}{2}$ or $\frac{1}{3}$; acute to subobtuse or acuminate. *Corona* rarely absent or nearly so, of slender appendages about 0·5–0·75 mm. or less long, arising in groups in a circle or in a sinuate ring from near the base of the calyx tube or higher, sometimes subpapillate at their upper ends. *Staminodes* partly connate, the free portions linear-subulate or subulate, or linear-sub-spathulate, as long or longer than the rest, curving outwards and inwards or vice versa, with apices incurved, shorter, as long as or longer than the ovary stalk; the staminal collar adnate for a short distance or more of its length to the calyx tube forming 5 pockets or depressions. *Glands* flattened, capitate, variously shaped; stems erect, rarely recurved, short and broad or long, heads usually large, concave or level above, rarely bilobed. *Ovary* stipitate, ovate to obicular or oblong or ellipsoid, smooth or prominently veined, rarely furrowed or ridged or uneven; style 3-branched, very rarely 2-branched, the unbranched portion up to $\frac{2}{3}$ the length of the ovary or almost absent; stigma pufflike, woolly fleshy; ovules numerous. *Fruit* "orange" "brilliant orange", "yellow"? "crimson", "red-purplish" ovoid-oblong or ellipsoid, 3-valved, dehiscent; seeds flattened, roundish-sub-pearshaped, regularly pitted. *Adenia senensis* (Kl.) Engl. *Bot. Jahrb.* 14 (1892), 375. *Adenia digitata Burtt Davy Ann. Transv. Mus.* 111. 121.—*Modecca digitata Harv. Thes. Cap. p.*8. *A. multiflora Potts Ann. Transv. Mus. V.* 235. *Clemanthus senensis* Klotsch, *Peters Reise Mosamb. Bot.* 143. *Modecca senensis Mast. Oliv. Fl. Trop. Afr.* 11, 517. *Adenia angustisecta* Burtt Davy. Kew. Bull* 1921. 280. *Adenia stenophylla* Harms. *Eng. Bot. Jahrb. XXVI*, 238. *Adenia Buchananii* Harms. ex Engler in *Engl. Pflanzenw. Afr.* 111, 2. (Engl. and Drude Veg. d. Erde IX) 605, (1921) in obs.

TRANSVAAL.—Pretoria district: Middelkop farm near Pienaars River, C. 3680 fts Jan. 1926, *Smith* 2120, ♀ (N). Hartebeestpoort, *Jackson*, ♀ (N). Rooikop, 5.1.36, *Smut. and Gillett* 3450, ♀ (N). Pienaars River Station, Oct. 1932, *Osborne* in N. 2639, ♂ (2 sheets). Without precise locality, 23.1.23, *Osborne* in N. Rust-der-Winter, Jan. 1936, *Pole Evans* 3886, ♀ (N). Strubenskop, 18.1.36, *Munro* in N, ♀. Farm Zeekoegat, Swingbridge, 27.1.34, *Schweickerdt* 1090, ♀ (N). Bon Accord, W. Pyramid Hill, 12 M. north of Pretoria, 4,200 ft., 6.4.32, *Mogg* 12388, ♀ (N). From Onderstepoort Poisonous Plant garden Nov. 1934, *Liebenberg* 3224, ♀, 3223, (n). Pretoria, Febr. 1912 *Rogers* in T. 12041. Without precise locality Magaliesberg *Zeyher* (S.). Brooklyn, Mar. 1914, *Pott.* 4826 (T). Hammanskraal, hard deep compact clay, 17.10.34, *de Lange* 76, ♂ (N). Baviaanspoort, Febr. 1914, *Fehrson* in T. 13768, ♂ (T.), 3 sheets. Hammanskraal, red gravel, 17.10.34, *von Malititz*, 60 (N). Potgietersrust district; ? at Potgietersrust 3.11.08, *Leendertz* 6007, ♂ (A & T). ? Potgietersrust, 21.12.28, *Govt. Analyst* in N. 7817, ♀. "Mosdene" near Naboomspruit, loam formation climbing over bushes, 10.11.19, *Galpin* 477 M, ♂ (N). Ditto, 25.2.19, *Galpin* 142 M, ♀ (N & S). Ditto, in *Acacia* veld stems 1–2 M. arenate, climbing up bushes, fls. creamy tuber very large, 3,800 ft. 21.11.34, *Galpin* 13196, ♀ (N.) Rustenburg district; Brits, 29.12.27, *Watt and Brandwyk* 2045, ♀ (N). Ditto, 17.11.27, *Watt and Brandwyk* 2038, ♀ (N). Farm Welgevonden, 3,200 ft. 8.12.34, *Mogg* 14609, ♂ (N). Brits, 20.12.27, *De Ridder* in N. 7504, ♀ (2 sheets). Middelburg district; Niebo, Oct. 1921, *Rogers* 24853, ♂ (T). Potchefstroom district; on experimental farm, 5.1.31, *Theron* 5, ♀ (N). Bechuanaland; Mochudi, May 1914, *Rogers* (W). Saberones, 10.12.36, *Watt and Brandwyk* 1683, ♀ (N). Mochudi, Jan. 1915, *Harbor* in T. 17027, ♀. Lydenburg district; Farm Schoonoord, Sukukuni, poisonous, black clay soil between norite boulders, 4,000 ft. 8.3.37, *Barnard* 229 A. Foothills, Camp

* *A. augustisecta* Engl. & Harms ex Engler, Pflanzenwelt Afr. III, 2 (1921), p. 605, in obs. was the original name for *A. stenodactyla* Harms which now stands as Burtt Davy published his description first, necessitating Harms to change his epithet.

HB. Schoonoord 4,500 ft., 3.12.33, *Barnard* 229, ♀. Farm Korenvelden near Sukukuni, tuber topshaped, poisonous, 3,500 ft., 3.12.34, *Barnard* 153 (6 sheets). Ibid, small bulb, poisonous, used by natives, 3,000 ft., 8.11.34, *Barnard* 155. Ibid, 3,000 ft., 13.3.35, *Barnard* 305, ♀, all in N. Ohrigstad valley, 23.10.08, *Mundy*, in Bolus Herb. 4,700, ♀. Barberton District; without precise locality (? at Barberton), Nov. 1931, *Smith* 7019, ♀ (N). On road to Carolina (? from Barberton) ± 4,000 ft., 5.10.30, *Bremekamp* in T. 28575, ♂. Glenthorpe farm, 1.11.11, *Scheuble* in T. 10908, ♂. Without precise locality (? at Barberton) Jan. 1908, *De Beer* in T. 4940, ♂. Dry hillsides at Barberton, twining on shrubs, 2,000–2,800 ft., 1889 A.D., *Galpin* 677, ♂ & ♀ (N. 2 sheets), T & S.). ? at Barberton, 2,900 ft., 21.11.88, *Thorncroft* 15, ♂ (B). Ditto, Nov. 1909 *Williams* in T. 7645, ♀. Hyslops Creek, trailing, 2,500 ft., Apr. 1926, *Thorncroft* 2141, ♂ (N). Nelspruit district; Northern slopes of Amajuba mt., Schagen, climbing on trees, etc. stems several ft. long, 3,000 ft., Dec. 1934, *Liebenberg* 3362, ♀ (N). Ditto grown at Div. Pl. Ind. gardens, Pretoria, 19.1.37. Same locality, long stems, climbing, bulb 10–12 cm. diam. turbinate, 3,000 ft., 28.12.33 *Liebenberg* 3056, ♀ (N). At Schagen just off main road, 16 M. from Nelspruit, tuberous topshaped rootstock 15 cm. diam., climbing, stems several ft. long, 2,500 ft., Dec. 1934, *Liebenberg* 3301, ♂ & ♀, (N). Ditto, ♀ grown at D.P.I. gardens Pretoria, 19.1.37. From same locality but grown at D.P.I. gardens, *Liebenberg* 3055, ♀, (N). On farm Suidwalliskraal, on main road Nelspruit–Machadodorp, stems several ft. long, climbing, 2,800 ft., Dec. 1934, *Liebenberg* 3366, ♀ (N). On Research Station, Nelspruit, long stems climbing up trees, 2,375 ft., 1.11.30, *Liebenberg* 2544, ♀ (N). Plaston, climbing herb, 3,000 ft., Oct. 1931, *Holt* 75, ♂ (N). White River, Oct. 1919, *Rogers* 23288, ♀ (U & N). Doornkraal, 28.12.23 *Stubbs* ♀ (N). Mayfern, (grown at D.P.I. gardens, Pretoria), April 1929, Mogg 8182, ♀ (N), (2 sheets). Pietersburg district; Tzaneen, 8.12.36, *Hattingh* PS. 227, ♀ (N). Rooikoppies, Politsi, climber open parts of forest, Dec. 1932, *Schweickerdt* 1037, ♂ & ♀ (N. & T.), 4 sheets. Woodbush, de Hoek, Dec. 1931, *Schweickerdt* in T. 30164, ♂, 2 sheets. Haenertsburg, Nov. 1913, *Pott* in T. 13368, ♂. Westfalia Estate, 17.11.36, *Pole Evans* 3983, (N.). Haenertsburg, Nov. 1917, *Moss and Rogers* 884, ♀ (U.), 2 sheets. Zoutpansberg district; Elim, Dec. 1930, *Obermeyer*, in T. 29287 and 29288, ♀. Louis Trichardt, Dec. 1922, *Breyer* in T. 24215, ♂. Tshakoma, Nov. 1931, *Obermeyer* in T. 30349, ♀. Pigeon Hole, 28.10.18, *McCallum* 70, ♀ (N). The Downs, Nov. 1918, *Rogers* 21937, ♀. (A, B. & T.). Middelburg district, Tautesberg, 9.11.33, *Young* A. 247, ♂ & ♀ (T), 3 sheets. Natal: Vryheid ditriets; Oct. 1905, *Sim* 2922, ♀ (B), 2 sheets. At Roman Catholic Miss. Stat. on Inkawana, on the Vryheid side of Besters Spruit, between diabase, strictly dioecious, 3 ft. high, ♂ flowers yellow, ♀ flowers green, poisonous, abundant. 4,000 ft., 20.10.37, *Gerstner* 2330 and 2331. ♂ & ♀ (N.). Nongoma district; at Nongoma, native name Umbulele (=poisonous plant), 20.1.38, *Gerstner* 2896 (N). Kruger National Park; Baiandbai, 24.11.32, *Lang* in T. 32154, ♂. Ditto, 25.11.32, *Lang* in T. 32153, ♀.

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Plate 1.—*A. fruticosa* Burtt Davy. At Naauwpoort, near Pietersburg, Transvaal.
[*Photo by H. Lang.*

Plate 2.—*A. Fruticosa* Burtt Davy. At Naauwpoort, near Pietersburg, Transvaal.
[*Photo by H. Lang.*

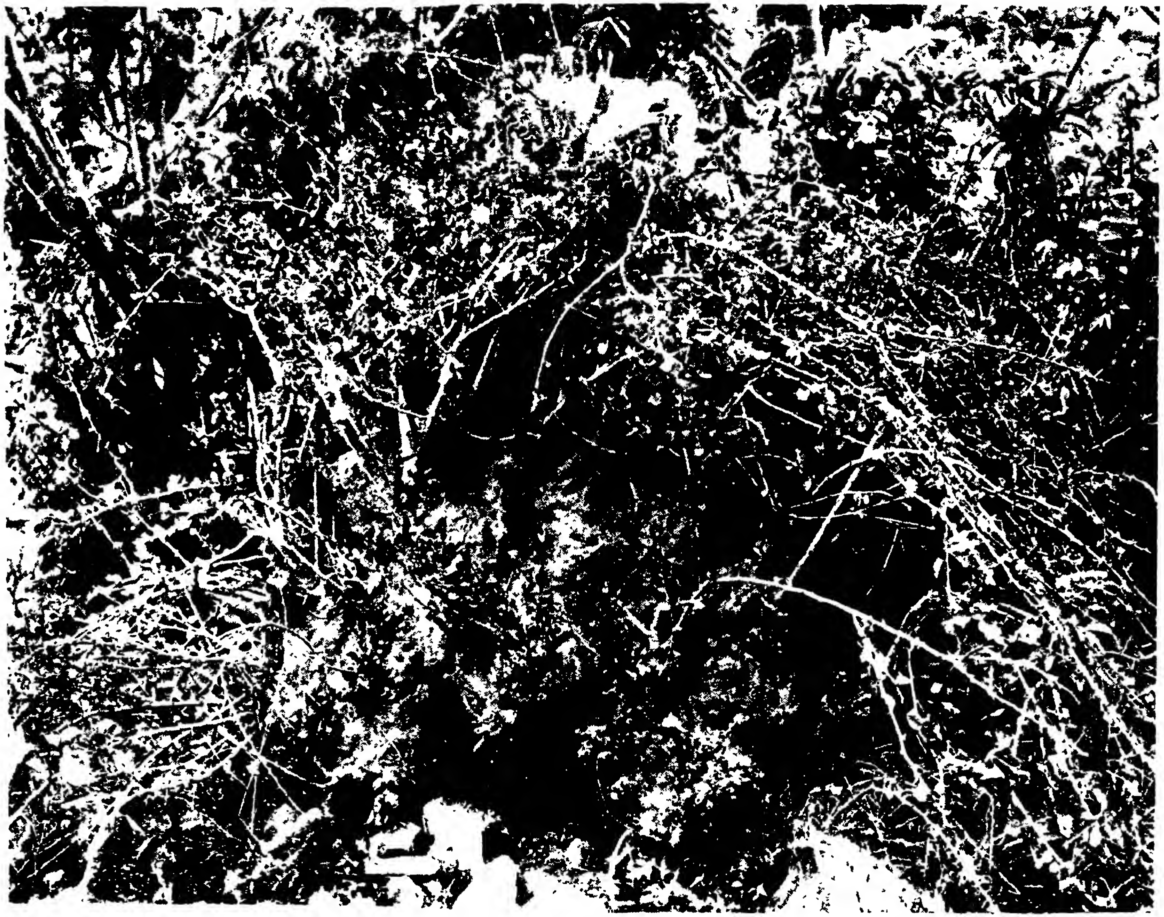


Plate 3.—*A. spinosa* Burtt Davy. At Naauwpoort, near Pietersburg, Transvaal.

[*Photo by H. Lang.*

Plate 4.—*A. glauca* Schinz. From Fairy Glen, near Pretoria. The light portion and below this was underground.

]*Photo by H. King.*

Plate 5.—Flowers of *A. glauca* Schinz. [*Photo by H. Lang.*

Plate 6.—Fruits of *A. digitata* (Harv.) Engl. [*Photo by H. Lang.*

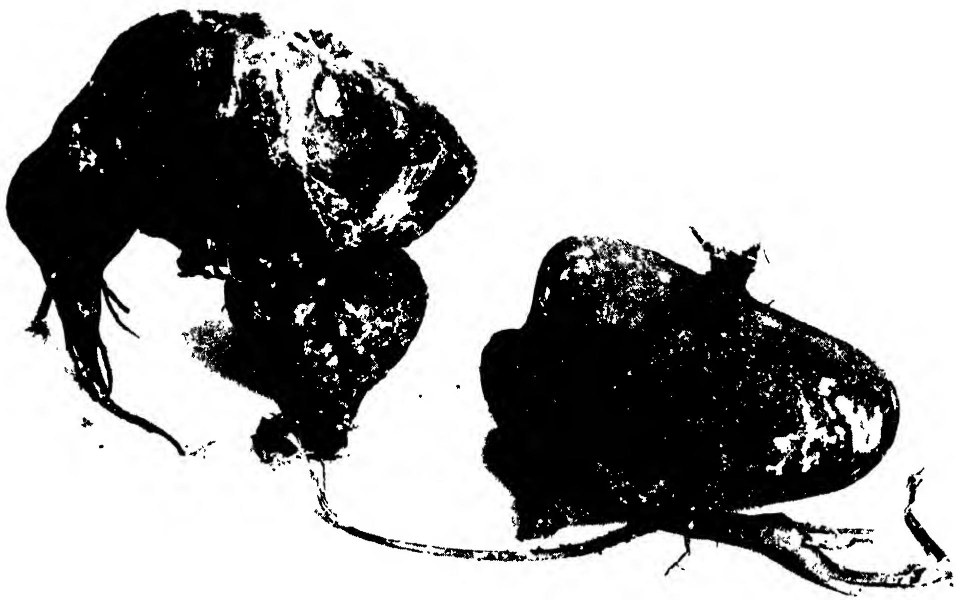


Plate 7. Two tubers of *A. digitata* (Harv.) Engl., found side by side at Baviaanspoort, outside Pretoria. The one was partly exposed and green; the other was underground.

[*Photo by H, King.*

Plate 8.—A photo of the type specimen of *A. digitata* (Harv.) Engl.
[*Photo by courtesy of Kew Herb.*

Plate 9.—Photo of one of the type specimens of *Clemanthus senensis* Kl. ([*A. senensis* (Kl.) Engl.]. These specimens were collected at "Rios de Senna" and therefore was very likely the same locality where Kirk later collected his specimens (plates 12–14) which Masters described as *A. senensis*. Mast.

[*Photo by courtesy of Berlin Herb.*

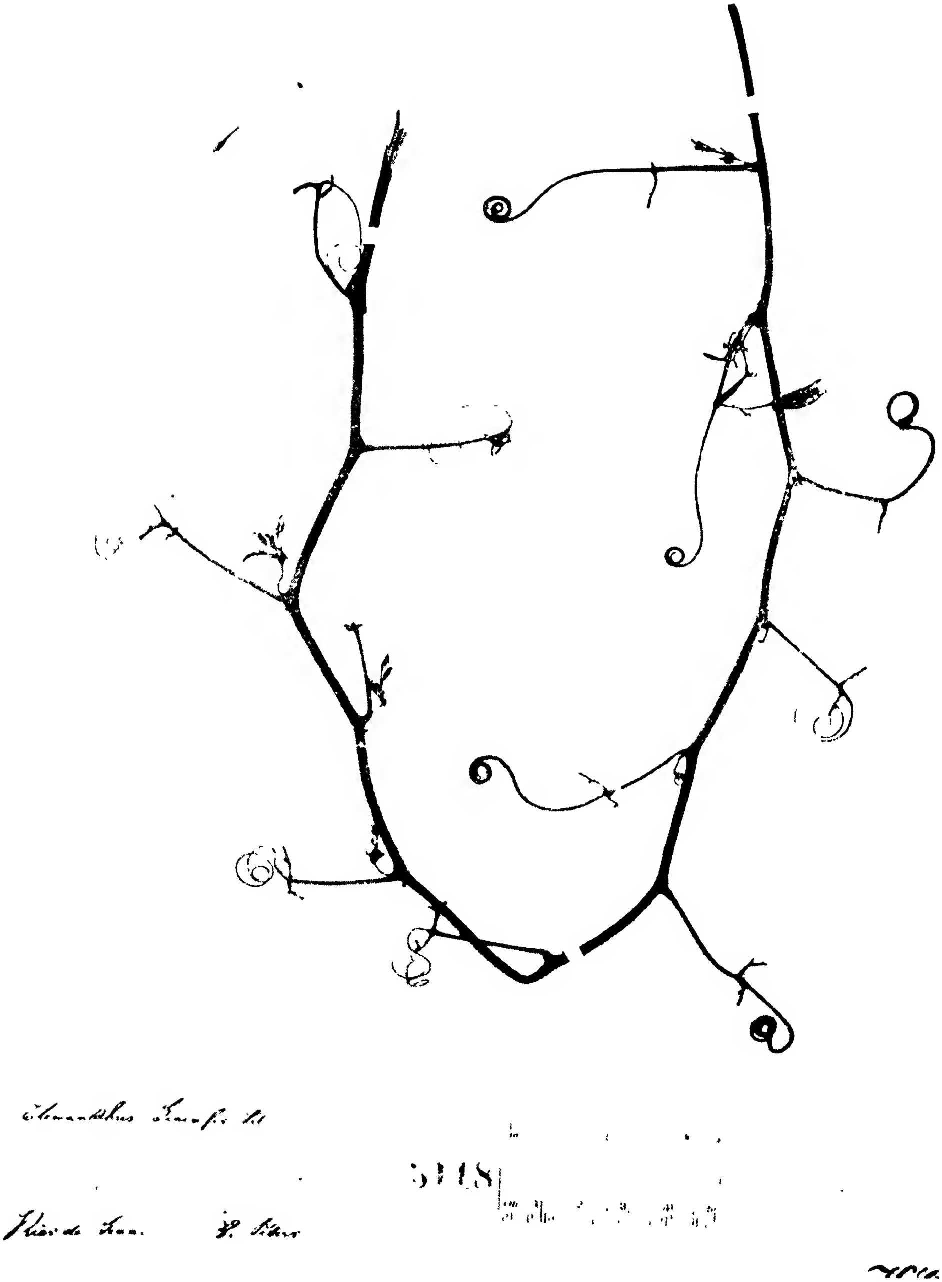


Plate 10. Photo of one of the type specimens of Clemanthus senensis Kl [*A. senensis* (Kl.) Engl.].

[*Photo by courtesy of Berlin Herb.*

Plate 11.—Photo of the type specimen of *A. Buchanani* Harms.

[*Photo by courtesy of Berlin Herb.*

Plate 12.—Photo of one of the specimens collected by Dr. Kirk at Senna, Zambezi, and from which Masters (Fl. Trop. Afr. Vol. 2) described *A. senensis* Mast. Practically all lobes are entire. [*Photo by courtesy of Kew Herb.*

Plate 13.—Photo of one of the specimens collected by Dr. Krik at Senna, Zambezi, and from which Masters (F. Trop. Vol. 2) described *A. senensis* Mast. Practically all the median and side lobes are lobed.

[*Photo by courtesy of Kew Herb.*

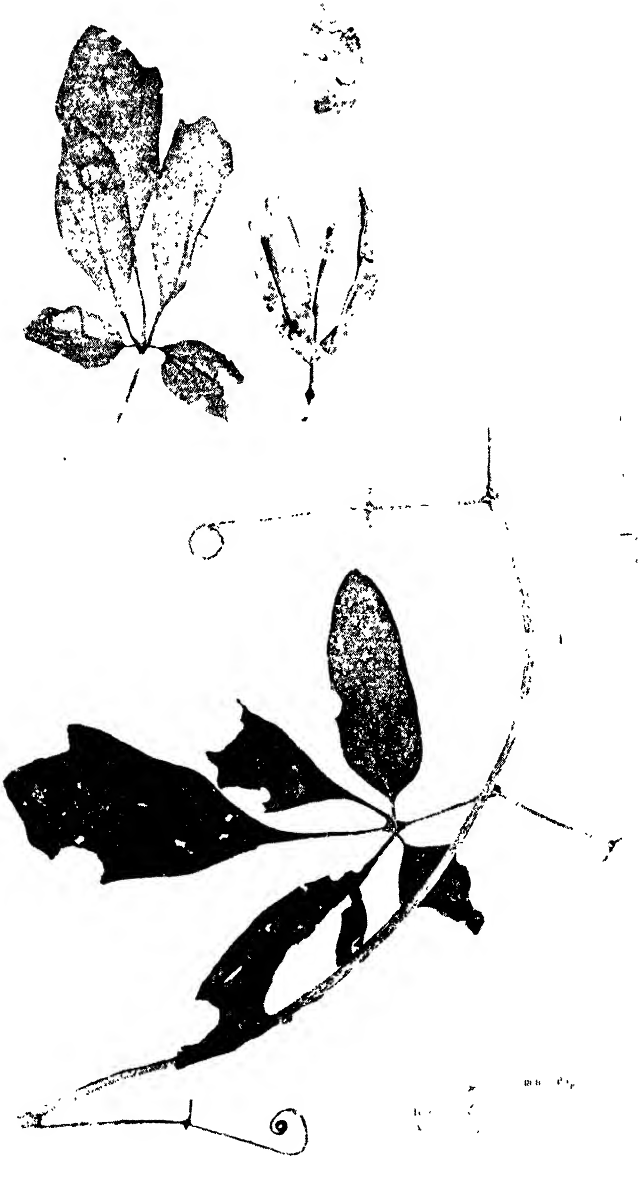


Plate 14.—Photos of one of the specimens collected by Dr. Kirk at Senna, Zambezi, and from which Masters (Fl. Trop. Afr. Vol. 2) described *A. senensis* Mast. The median lobes are only slightly lobed.

[*Photo by courtesy of Kew Herb.*

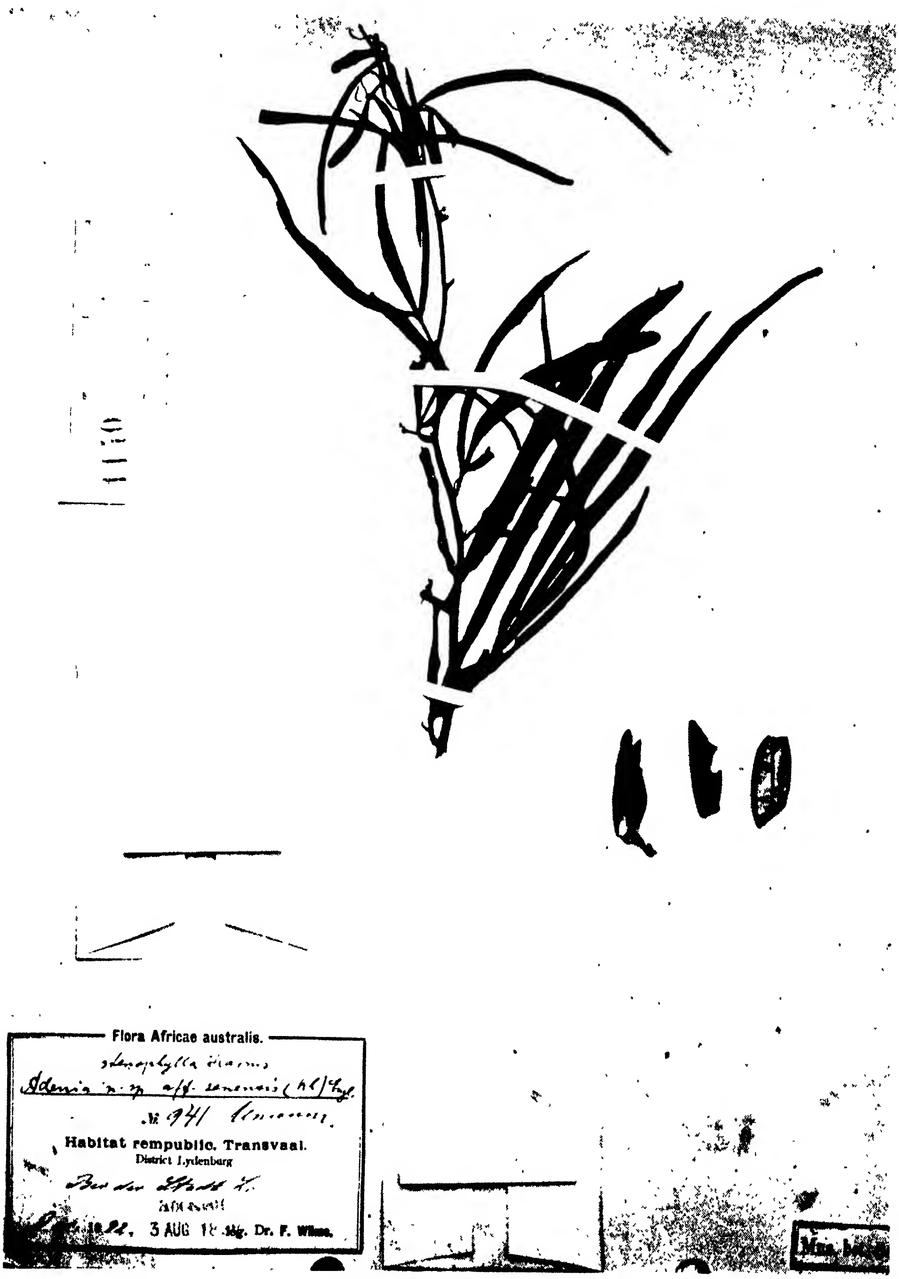


Plate 15.—Photo of the type specimen of *A. stenophylla* Harms.
Photo by courtesy of Berlin Herb.

Plate 16.

Plate 17.

Plate 16.—A photo of Mundy in Bolus Herb. 4700, , from Ohrigstad valley. It is the type specimen of *A. angustisecta* Burtt Davy. In morphology of floral structures it resembles *A. digitata* and in leaf form it links up with other Lydenburg specimens (plate 17, etc.).

Plate 17.—A photo of Barnard 153 (1), showing 3-4 and 5-lobed leaves (entire).

[*Photos by H. King.*

Plate 18.

Plate 19.

Plate 18.—A photo of Barnard 155, showing all 5-lobed leaves (entire). *A. stenophylla* Harms (plate 15) fits in here.

Plate 19.—A photo. of Barnard 155 (collected leaves). All Barnard specimens are from Sukukuni, not very far from Lydenburg.

[*Photos by H. King.*

Plate 20.

Plate 21.

Plates 20 and 21.—These are photos of other Barnard specimens showing various degrees of lobing in the direction of the typical I. *digitata*.

[*Photos by H. King*.

Plate 22.

Plate 23.

Plate 22.—This is a photo of another Barnard specimen showing various degrees of lobing in the direction of the typical *A. digitata*.

Plate 23.—A photo of Schweickerdt in Trans. Mus. Herb. 30164, ♂. In leaf-shape it resembles the previous. The inflorescence is more elaborate.

[*Photo by H. King.*

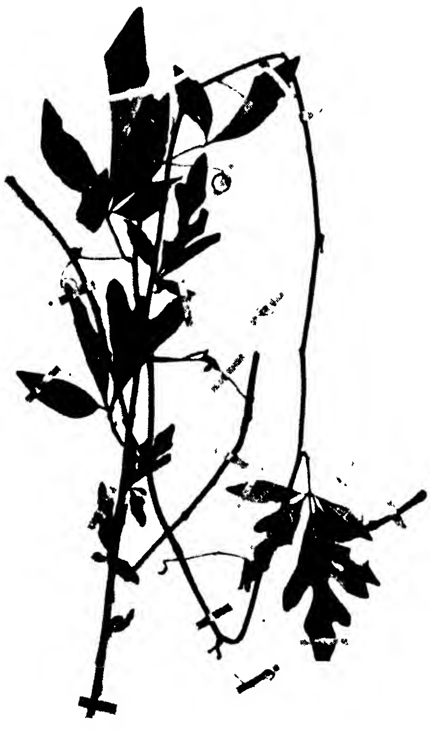


Plate 24.

Plate 25.

Plate 24. A photo of Liebenberg 3362. This links up with plate 23.

Plate 25. A photo of Liebenberg 3366. This is from the same locality as that of plate 24, but from a different habitat, showing no lobing. [*Photo by H. King.*

Plate 26. -A photo of a specimen from the same tuber as Liebenberg 3366 (plate 25) but grown at the gardens of the Division of Plant Industry, at Pretoria. The specimen shows characteristic lobing. It is identical to Liebenberg 3362 when grown at the D.P.I. gardens, but the latter was not used as it would not have made such a good photo.

[*Photos by H. King.*

Plate 27.

Plate 28.

Plates 27 and 28.—Photos of Galpin 677 (2 sheets), showing variation of the lobing. These link up with plate 26.

[*Photos by H. King.*

Plate 29. -Photo of Williams in Trans. Mus. Herb. 7645.

Plate 30.--Photo. of Smith 7019.

These link up with plate 28. Compare these with the photo of the type specimen (plate 8).

[*Photos by H. King.*

Plate 31.—Photo of Scheuble in Trans. Mus. Herb. 10908, ♂.

Plate 32.—Photo of Bremekamp in Trans. Mus. Herb. 28575, ♂.

These link up with plate 18 on the one hand and with plate 25 on the other hand. The link between plates 32 and 35 is not very clear but is due to the fact that Liebenberg 3301 was omitted to reduce the number of plates.

[*Photos by H. King*

Plate 33.—A photo of Thorncroft 15, ♂. This links up with Liebenberg 3366 and 3362 (plates 24 to 26).

[*Photo by H. King.*

Plate 34.

Plate 35.

Photo of Obermeyer in Trans. Mus. Herb. 29287, .
Photo of Obermeyer in Trans. Mus. Herb. 30349, .
These link up with plate 33 and is where *A. senensis* Masters (plates 12, 13 and 14) fits in.
Compare the flowers on plate 34 with those on plates 33 and 23.

Plate 36. Photo of Barnard 229, ½. This links up with plates 34 and 35 and this is clearly also where *A. Buchananii* Harms (plate 11) fits in.

Plate 34.

Plate 35.

Photo of Obermeyer in Trans. Mus. Herb. 29287. ..
Photo of Obermeyer in Trans. Mus. Herb. 30349. ..
These link up with plate 33 and is where *A. senensis* Masters (plates 12, 13 and 14) fits in.
Compare the flowers on plate 34 with those on plates 33 and 23.

Plate 36. Photo of Barnard 229, [illegible]. This links up with plates 34 and 35 and this is clearly also where *A. Buchananii* Harms (plate 11) fits in.

A REVISION

of the

SOUTH AFRICAN SPECIES OF HYPERICUM

by

H. C. Bredell.

The first reference to a South African species of *Hypericum* appears in *Thunb. Prod. Fl. Cap.* 169 (1800) where a concise description of *H. aethiopicum* Thunb. is given. In *DC. Prod. I*, 550 (1823) another species *H. Lalandii* Choisy is enumerated and is also described in the *Fl. Trop. Afr.* 1 : 155 (1868). In *Fl. Cap.* 117 (1859–1860) only three species were enumerated and a few years later Wood & Evans described *H. natalense* from Natal (*Journ. Bot.* XXXV : 487 (1897). In *Bull. Herb. Boiss* 179 Sér II, VIII, 1908, *H. Wilmsii* Rob. Keller appears in the author's key as a new species recorded from the Transvaal. Keller probably overlooked the description of *H. natalense* and described the same plant as *H. Woodii* in Engl. *Jahrb.* LVIII 193 (1923). The most recent revision of Tropical species appeared in *Journ.* of *Bot.* 329 (1927), where Good included the two South African shrubby species *H. leucoptychodes* Steud. and *H. Roeperianum* Schimper.

In the present revision only the South African species of the genus have been dealt with but as some species extend southwards from Tropical Africa, accounts of other species from this region have also been studied and compared with the South African plants. (Unfortunately most of the work has been carried out on dried specimens, fresh material of most species not being available at the time.) The large number of specimens investigated gave a good idea of the variability of most of the species and the search for constant specific characters in closely allied species proved to be a difficult task.

General Notes and Distribution.

South African species of *Hypericum* are recorded from South West Africa, the Cape Province extending inland and along the east coast as far north as Tropical Africa. Most of the species show an overlapping in distribution but others appear to be restricted to certain areas with the same climatic conditions. The variations and distribution of the different species are not only interesting from an ecological point of view but have proved useful in determining some of the species. In the accompanying maps the distribution of each species is shown.

Of all the species examined *H. Lalandii* Choicy (Fig. 1) shows the greatest range of variation in shape and structure of the vegetative parts. In almost every account of this species the authors refer to small plants $\pm$ 10 cm. high with very short leaves. According to Keller some forms are unbranched whereas others are branched from the middle. He also noticed the variations in size and shape of the leaves and showed that the typical form has the stems unbranched, medium-sized leaves (1 cm. long, 1–2 mm. broad) and flowers 1·5 cm. in diameter. Most of the specimens studied, fitted these earlier descriptions but a number of plants were different from the typical form. In plants branched from the middle, the leaves were usually larger, somewhat rigid in texture and more or less glaucescent. The specimen with the largest leaves *Payn* 33 collected at Tsolo (Tembuland) had some leaves which measured 3·7 cm. long and 1·7 cm. broad.

The varieties *lanceolata* and *latifolia* described by Sonder and the variety *lanceolatum* described by Keller are chiefly distinguished from the typical form by variations in leaf-size. Many of the specimens fitted these descriptions very well, but a number of successive transitional forms between the short, and long-leaved, narrow, and broad-leaved forms rendered it impossible to separate these extreme forms and to group them into the above varieties (Fig. 1, *a–h*). In the variety *macropetala* described by Sonder, the petals are twice as long as the sepals a character which after careful measurement and comparison of the relative length of the sepals and petals in almost all the specimens, does not seem to be constant in any group of similar plants within the species. In the writer's opinion all plants, exhibiting these varying characters would be better considered as forms of the typical *H. Lalandii* with the variation in leaf-size probably due to the influence of a changed habitat; some growing in open and some in sheltered places. It is interesting to note that most of the broad-leaved specimens were collected near and along the east coast of Natal. A few specimens recorded from the eastern Transvaal which differed remarkably from the rest in having rigid glaucescent leaves, with the stems and leaves densely and prominently yellowish pellucid-dotted have been described as a new variety *transvaalense*. These characters are very constant and no intermediate forms were found.

The species is widely distributed from the southern Cape, along the east coast and inland as far north as Southern Rhodesia and is also recorded from South West Africa.

H. aethiopicum Thunb. (Figs. 2, 7 and 9) may be distinguished from *H. Lalandii* by its round stems, ovate leaves and black-dotted sepals and petals. The variety *glaucescens* described by Sonder on characters such as dwarf erect stems, glaucescent closely-set black-dotted leaves longer than the internodes, cannot be upheld because all these characters proved to be very variable in the great number of specimens examined. Moreover, the glaucescent leaves present in a few specimens do not justify a separation of these from the others because this character cannot be correlated with any other constant feature. This species extends south of north eastern Cape (Matatiele) as far as the Riversdale district.

H. Sonderi Bredell sp. nov. (Fig. 6) is closely allied to H. *aethiopicum* but differs from it in having spotted stems and *no* stalked gland-like protuberances along the margins of some bracts and sepals. All plants exhibiting the above characters have been previously named *H. aethiopicum*. In the description of *H. aethiopicum* Sonder refers to the toothed sepals as being an outstanding characteristic of the species. It is also interesting to note that there is almost no overlapping in the distribution of the two species. *H. Sonderi* extends southwards only as far as the north eastern Cape (Aliwal North) and *H. aethiopicum* is not known to occur north of Matatiele. A few specimens collected in the Pietersburg district, Transvaal, and which I have described as a new variety, *transvaalense* of *H. Sonderi* exhibit characters which link with *H. aethiopicum* and *H. natalense*. The flowers resemble those of *H. aethiopicum* in almost every detail but the leaves are much more like those of *H. natalense* being slightly membranous but larger.

H. Wilmsii R. Keller of which I have seen the type, shows an affinity with *H. aethiopicum* (Figs. 8 and 10) but the plants are usually small and more or less procumbent. Characters such as the oblong rounded sepals and the presence of black dots along the margins of the sepals and petals also links the species with *H. natalense.* This species occurs on mountains in the northern Cape, Basutoland and Transvaal. In the Flora Capensis Sonder referred *Drége* 7530 in Herb. Sond. collected at the Cape without precise locality, to *H. humifusum* Linn., a typical European species. He also states that the Cape specimens of this species are taller than usual but not otherwise different from the species. At Kew Dr. H. G. Schweickerdt very carefully compared *Drége* 7530 with the typical *H. humifusum*, and came to the conclusion that Drége's plant is not *H. humifusum* and that it is the same species as *Dieterlen* 1222 cited under *H. Wilmsii* in this revision. The European plant does therefore not occur in South Africa.

According to Medley Wood and Maurice Evans who described *H. natalense* (Figs. 3, 4, 8, 10) this species " has much the appearance of *H. aethiopicum* for which it has doubtless been mistaken ; but it differs in having more numerous stems from the root . . . leaves which are subsessile and not amplexicaul, flat not revolute edges, sepals which are not lanceolate or acute ; in the absence of black dots from the sepals, petals and anthers and by its 5 styles and 5-celled capsule." These observations were based on the type *Medley Wood* 4034 of which I have seen two duplicate specimens. After a careful examination of these it was found that some leaves showed revolute margins, at least in the dry state, that a few black dots are present along the margins near the apex of at least some petals and sepals, that the anthers are furnished with black dots and that the number of styles and chambers in the ovary may vary from 3 to 5. All the characters were confirmed in subsequent examinations of a number of specimens which undoubtedly are the same as *Medley Wood* 3034. These characters probably had been overlooked by the authors. Robert Keller overlooked the description of *H. natalense* and described a new species *H. Woodii* from *Medley Wood* 3034. In the description of *H. Woodii* Keller showed that the number of styles and chambers in the ovary may vary from 3 to 5 and remarks that the species " nimmt . . . innerhalb der Subsectio Homataenium durch die Veranderlichkeit in der Zahl der Fruchtblätter eine Sonderstellung ein ". Although the species appears to be mostly confined to the province of Natal it occurs south as far as the Kentani district.

A specimen collected at Camperdown by Franks (Government Herb. Natal 12968) resembles specimens of *H. natalense* in most respects but the leaves are obovate with a short but distinct petiole. I have described this specimen as a new variety *petiolatum* (Fig. 4).

H. leucoptychodes Steud (Fig. 5) and *H. Roeperianum* (Fig. 11) Schimper differ from the other South African species of *Hypericum* in being shrubby with large flowers and relatively large leaves. Good in his account on the shrubby species of *Hypericum* of Tropical Africa pointed out that the best characters for primary classification are those of leaf-features, particularly the type of venation as seen on the under side of the leaf. *H. leucoptychodes* may therefore be distinguished from *H. Roeperianum* in having the tertiary venation slightly conspicuous giving the effect of small striae and pellucid veins ; the tertiary venation in the leaves of *H. Roeperianum* is closely reticulated so as to form small but distinct meshes. According to Good the styles are almost united to the tip in *H. Roeperianum.* I have seen *Eyles* 795 and *Teague* 214 cited by him under *H. Roeperianum* and in neither of these could partly free styles be found. Subsequent investigations of a great number of specimens belonging to this species showed that the styles are always connate to the tip, with the stigma distinctly 5-lobed. Of the two species, *H. leucoptychodes* appears to have the wider range in South Africa, extending southwards from the tropics as far as north-eastern Cape. In South Africa *H. Roeperianum* is only recorded from the Lydenburg district of the Transvaal.

ACKNOWLEDGMENTS.

I am greatly indebted to the Chief, Division of Plant Industry, Dr. I. B. Pole Evans and the Principal Botanist, Dr. E. P. Phillips for granting me the privilege to undertake this revision and for the valuable assistance and guidance which I have received from the latter. Dr. H. G. Schweickerdt was kind enough to compare certain specimens with the types at Kew and to advise me on some new South African species described by Rob. Keller.

I have to acknowledge with thanks the loan of specimens from the Transvaal Museum, Pretoria; the Herbarium of the South African Museum, Capetown: the Herbarium of of the Albany Museum, Grahamstown; and the Natal Herbarium, Durban.

The following symbols accompanying the citations indicate the different herbaria where the specimens are kept.

- A. Albany Museum, Grahamstown.
- C. The Herbarium of the South African Museum, Capetown.
- P. National Herbarium, Pretoria.
- G. Galpin's Herbarium in P.
- M. Marloth's Herbarium in P.
- N. Natal Herbarium, Durban.
- T. Herbarium of the Transvaal Museum, Pretoria.

DESCRIPTION OF THE GENUS.

Shrubs or perennial herbs from a woody base. *Leaves* opposite, sessile, amplexicaul or shortly petiolated, entire, mostly pellucid-dotted, with or without reticulated veins. *Stipules* 0. *Inflorescence* a loose or compact cyme or flowers terminal on short lateral branches. *Flowers* yellow, bisexual, regular. *Sepals* 5, equal or subequal, acute or rounded at the apex, pellucid-dotted, with or without glandular stalked protuberances along the margins. *Petals* 5, twisted in bud, distinctly veined with black spots on the surface and margins or along the margins only. *Stamens* indefinite. *Filaments* thread-like, free or connate at the base into 3–5 distinct or indistinct groups. *Anthers* with or without black or yellow spots. *Ovary* superior, sessile, ovate to subround in outline, 3–5 chambered, with few to many ovules on parietal placentas; styles 3–5, free, or connate to the tip; stigmas small, capitate. *Fruit* a capsule with few to many seeds.

KEY TO THE SPECIES.

A¹ Stems 4-sided or 4-ribbed; sepals and petals without black dots.

- a¹ Leaves and stems very prominently and distinctly yellowish pellucid-dotted; leaves linear-lanceolate, glaucescent. *H. Lalandii* var. *transvaalense*.
- a² Leaves and stems variously dotted but not as in var. *transvaalense*; leaves linear to ovate-lanceolate, glaucescent or not. 1. *H. Lalandii*.

A² Stems round and smooth; sepals and petals usually black-dotted.

- b¹ Herbs or half-woody plants; flowers small, stamens connate at the base into 3 or 4 irregular groups.
  - c¹ Sepals linear or linear-lanceolate, acute to sub-acute, equal; petals always black-dotted on surface and along the margins.
    - d¹ Bracts and sepals without marginal stalked bodies; stems usually spotted, occasionally without spots.
      - e¹ Leaves membranous, prominently dotted on abaxial surface; tertiary venation very distinct to form small meshes. *H. Sonderi* var. *transvaalense*.
      - e² Leaves not membranous, variously dotted; tertiary venation absent or if present not conspicuous on both surfaces. 3. *H. Sonderi*.
    - d² Bracts and sepals (at least some) with marginal black-tipped protuberances; stems spotless. 2. *H. aethiopicum*.
  - c² Sepals oblong to obovate, rounded at the apex, unequal; petals usually with a few black marginal spots near the apex.
    - f¹ Leaves sessile, elliptic to elliptic-oblong.
      - g¹ Plants 30–40 cm. high, erect; leaves 1·5–2 cm. long. 5. *H. natalense*.
      - g² Plants less than 20 cm. high, more or less procumbent; leaves usually less than 1 cm. long. 4. *H. Wilmsii*.
    - f² Leaves shortly petiolated (especially on young branches), obovate. *H. natalense* var. *petiolatum*.
- b² Bush or shrub; flowers large; stamens connate at the base into 5 distinct groups opposite the petals.
  - h¹ Styles connate to the tip with the free branches 1–2 mm. long; leaves 1·5–3 × 0·3–0·9 cm., narrowly lanceolate. 6. *H. leucoptychodes*.
  - h² Styles connate to the tip with the stigma 5-lobed; leaves 4–7 × 1·5–2·5 cm., elliptic-lanceolate. 7. *H. Roeperianum*.

1. **H. Lalandii** Choisy. in DC. Prod. 1: 550 (1823); Fl. Cap. 1: 118 (1859–1860); Fl. Trop. Africa 1: 55 (1868); Bull. Herb. Boiss. Sér II, VIII: 187 (1908); Engl. Jahrb. LVIII: 197 (1923); Engl. & Prantl. Nat. Pflantzenfam. ed. 2, XXI: 181 (1925). H. Lalandii Choisy. var. *lanceolata*, var. *latifolia* and var. *macropetala* of Sond. in Fl. Cap. 1: 118 (1859–1860); H. Lalandii var. *lanceolatum* Rob. Keller in Bull. Herb. Boiss. Sér II, VIII: 187 (1908).

Semiherbaceous, 6–55 cm. high. *Stems* from a woody underground rootstock, erect or decumbent below, branched or unbranched, 4-ribbed, glabrous. *Leaves* sessile, ascending, 0·5–3·6 cm. long, 0·2–1·5 cm. broad, linear to ovate-lanceolate or oblong-elliptic, obtuse to sub-acute, entire, with numerous more or less translucent dots, 1- to 7-nerved, glabrous. *Flowers* few to many in terminal cymes. *Bracts* 1–9 mm. long. *Sepals* 2–10 mm. long, 1·5–3 mm. broad, linear-lanceolate, subacute. *Petals* 3·5–12 mm. long, 1·5–5 mm. broad, oblong to oblong-spathulate, distinctly veined. *Stamens* indefinite, 2·5–7 mm. long; filaments thread-like, free or connate at the base into a few irregular groups; anthers 0·25–1 mm. long. *Ovary* 1·5–8 mm. long, 1·5 mm. broad, 3- to 4-chambered: ovules many; styles 3–4, free, 1–4·5 mm. long; stigmas capitate.

South West Africa.—Waterberg Plateau: *Boss* in T. 34997! 34998! 34999!.

Cape Province.—Caledon district: Sir Lowry's Pass, farm Knoshoek, *Marloth* 4866! P. Mosselbay district: Vryersberg, May, *Muir* 2043! P. George district: In humid places, *Schlechter* 2373! A, C; *Paterson* 1236! A; *Marloth* 2545! P. Knysna district: Hackerville, March, *Breyer* in T 23914!. Humansdorp district: Zitzikamma, May, *Fourcade* 173! A: Flats Ratelsbosch, Nov., *Fourcade* 539! A; *Britton* 1167! A. Uitenhage district: In Van Stadesbergen and on swarded places on the hills of Adow and Krakamma, Sept. Nov., *Zeyher* 361! A, C. Bathurst district: Trapps Valley, Dec., *Daly* 588! A. Albany district: Grahamstown, Hill slopes, Nov., *Galpin* 381! P; *Mac Owen* 192! A, N. and in Herb. MacOwanianum; *Daly* and *Sole* in T 12953!; Hill other side of Douglas Reservoir, April, *Daly* and *Sole* 141! A. Stockenstrom district: Katberg, *Galpin* 2072! P. East London district: Ovuton, very common in lands, growing in sandy soil, Dec., *Hilner* 379! A; June, *Rattray* 66! A. Komgha district: Komgha, among rocks, *Flanagan* 795! C, P. Kentani district: Sheltered damp places, *Pegler* 117! P in part. Port St. Johns district: Port St. Johns, *Wager* in P 21072!. Tsolo district: Tsolo, *Payne* 33! A. Flagstaff district: Fort William, Dec., *Tyson* 2828! A. Steynsburg district: Zuurberg, April, *Schonland* 3212! P, 3213! A. Maclear district: Maclear, *Murray* 25! A. Matatiele district: Cedarville, Mvenyani, near stream among rocks, Nov., *Bandert* 46! A. Griqualand without precise locality, *Tyson* 1230! C. *Prior* in P 21065! without locality.

Orange Free State. Fouriesburg district: Farm Dunelm, on mountain side in wet soil, *Potts* in Grey Univ. Coll. Herb. 3111! P. Bethlehem district: Bethlehem, railway enclosure in village, grassy and sandy places, common, Dec., *Phillips* 3215! P. Bothaville district: Bothaville, common in damp places, Jan., *Goossens* 1216! P. Heilbron district: Viljoensdrift, Jan., *Rogers* 4825! A, T.

Basutoland.—Leribe district: Leribe, slopes, banks, damp spots, *Dieterlen* 678! P; south slopes of Leribe Plateau, *Phillips* 792! 905! 914! C.

Natal.—Pinetown district: Durban, in humid places, *Medley Wood* 187! P and in N 852!. Polela district: Bulwer, Jan., *Bayer* 356! N. Pietermaritzburg district: Mount Ashly, *Mogg* 6375! P; Tweedie, *Mogg* 1192! P; Impolweni, Nov., *Rump* in N 20327!; Lidgetton, Jan., *Mogg* 6670! P, 6719! P; Allerton, Dec., *Mogg* 6536! P; *Dimock-Brown* 275! N. Umvoti district: Greytown, Nov., *Wylie* in N 21697! 21698! 20456! T 34130! 34131!. Eshowe district: Entumeni, Oct., *Wylie* in N 9253!. Entojaneni district: Ulundi, Jan., *Evans* 432! 19602! N; Melmoth, Dec., *Mogg* 6052! 4533! P. Estcourt district: Giant's Castle, Dec., *Symons* 290! T. Bergville district: National Park, Dec., *Galpin* 10177! P. Utrecht district: Farm Glen, Atholl, near Charlestown, Jan., *Smith* 5697! P.

Swaziland.—Mbabane district: Dalriach Mbabane, in swampy places, Dec., *Bolus* 11702! A.

Transvaal.—Wakkerstroom district: Jan., *van Dam* in T 24643!. Ermelo district: Nov., *Collins* in T 12201!; on farm Nooitgedacht, not frequent, Dec., *Henrici* 1348! and 1551! P. Heidelberg district: Dec., *Leendertz* 1030! T. Potchefstroom district: Losberg, *Theron* 768! T. Krugersdorp district: Krugersdorp, *Jenkins* in T 9229!. Johannesburg district: Jeppestown Ridge, Nov.-Dec., *Gilfillan* 6087! A, P in part, 6088! A, P; Houghton Estate, in low grassy places, April, *Bryant* C 30! P; Turffontein, *Bryant* D 10! D 34! P; *Jenkins* in T 10310!. Benoni district: *Bradfield* T 225! P; *Gilmore* 2186! P. Rustenburg district: Groenkloof, *van Dam* in T 10283!; Vlakfontein, ten miles west of Koster, in vlei, Feb., *Liebenberg* 126! P. Pretoria district: On open grassy veld below the Wonderboom, Jan., *Smith* 2291! P, 2252! P; Oct., *Leendertz* 3730! T; Oct., *Pole Evans* 408! P. Middelburg district: Klein Olifants River, along river banks, Nov., *Young* A 91! T; *Hewitt* in T 10443!; Dec., *Gilfillan* 7163! A. Carolina district: *Rademacher* in T 7284!. Belfast district: *Leendertz* 2688! T; *Jenkins* in T 6800!.

Barberton district: Umlomati Valley, Feb., *Galpin* 1284! A, P; Berlin, Godwan River, Jan., *Hofmeyer* in P 21070!; Kaapsche Hoop, *Gilmore* 2229! P; Nelspruit, Nov., *Rogers* in T 2389! A, T. Pilgrims Rest district: Sabie, Tweefontein Experimental Area, Feb., *Wagner* A 84! P; Pilgrims Rest, Dec., *Smuts* and *Gillett* 2318! P. Lydenburg district: Graskop, in vlei ground, damp and marshy places, not common, *Irvin* 3! P; Nov., *Wilms* in T 5836!; Mac-a-Mac Falls, Jan., *Burtt Davy* 5368! P. Waterberg district: Nylstroom, *van Dam* in T 19690! P; Naboomspruit, Mosdene, in grassy, sandy glades, *Galpin* R 257! P; Moorddrift, *Leendertz* 2148! T; Palala River, *Breyer* in T 21448!. Pietersburg district: Damp places, Shiluvane, *Junod* 4289! T, P; Woodbush, *Mogg* 14705! P, 14675! P; *Rehman* 6340! P; *Wager* in T 23087!; *van Dam* in T 25641!. Zoutpansberg district: Vlei plant, soil very moist, common, *McCallum* in P 21068!; farm Zoutpan, vlei behind homestead, *Obermeyer*, *Schweikerdt* and *Verdoorn* 204! P, T.

Southern Rhodesia.—Matopos: *Eyles* 3767! C. Bulawayo: Nov., *Eyles* and *Johnson* 1098! A, 1100! A. Marandellas: Grass plots, Govt. Farm, Nov., *Rattray* 343! P.

H. Lalandii Choisy var. *transvaalense* Bredell var. nov. Caules foliaque valde prominenter et pellucido punctati.

Transvaal.—Standerton district: Near Volksrust, *Gray* in P 22267!. Ermelo district: Feb., *Leendertz* in T 7779!; Jan., *Collins* in T 6345!; Govt. School, *Nel* 35! P; Farm Nooitgedacht, in veld, common, Feb., *Henrici* 1538! P. Bethal district: Hoggeveld, Trichardsfontein, Feb., *Rehmann* 6608! P. Middelburg district: Witbank, Zondagsfontein, Dec.-March, *Thode* A 2789! P, N: near Witbank station, Dec., *Gilfillan* 7162! P in Part.

2. **H. aethiopicum** Thunb. in Thunb. Prod. Pl. Cap. 138 (1800); DC. Prod. 1: 552 (1823); Engl. & Prantl. Nat. Pflanzenfam. ed. 2. XXI: 179 (1925). *H. aethiopicum* Thunb. var. *glaucescens* Sond. in Fl. Cap. 1: 118 (1859–1860).

Semiherbaceous, 10–40 cm. high. *Stems* few to many from a persistent rootstock, erect, branched, round and smooth, glabrous, *without black dots*. *Leaves* sessile, 0·5–2·4 cm. long, ·03–1·7 cm. broad, oblong to elliptic-ovate, rounded at the apex, entire, prominently veined; tertiary venation absent, if present meshes conspicuous on upper surface only. *Flowers* in terminal lax or compact cymes. *Bracts* 3·7–7 mm. long, ovate to linear-lanceolate, acute or obtuse and with *stalked, black-tipped protuberances* along the margins. *Sepals* 4·5–7·5 mm. long, 3·5–5 mm. broad, oblong to linear-lanceolate, acute and with *stalked black-tipped protuberances* along the margins. *Petals* 0·6–1·5 cm. long, 3·5–0·5 mm. broad, oblong to oblong-spathulate, black-dotted along margins and on the surface. *Stamens* indefinite, 4·5–9 mm. long, filaments thread-like, free or usually connate at the base into 3 or more irregular groups; anthers 0·5 mm. long with or without black spots. *Ovary* 2·5–4 mm. long, ovate in outline, 3- or very occasionally 4-chambered; styles 3 or occasionally 4, free; 2·5–6 mm. long; stigmas capitate.

Cape Province.—Riversdale district: Corente Riv., *Muir* 855! C, P; 4774! C. George district: Nov., *Prior* in P 21066!. Knysna district: Gully, N.E. of Royal Hotel facing west, Dec., *Schonland* 3498! A; March, *Breyer* in T 23357!; Plettenbergs Bay, without name of collector in C 29506!. Humansdorp district: Assegaaibos, Nov., *Marloth* 10931! P. Uitenhage district: Oct., *Zeyher* 149! C, 360! C in part. Albany district: Grahamstown, Howisons Poort, *McOwan* 397! A, N; grassy slopes Elandskloof, *Galpin* 382! A, P. Bedfort district: Dec., *Bennie* 213! A. Fort Beaufort district: Adelaide, Great Winterberg, Jan., *Ford* 11410! P. Stockenstroom district: Katberg, Nov., *Sole* 383! A. Victoria East district: Victoria East, *Rattray* 130! P. Kingwilliamstown district: Grassy places at foot of perie, *Flanagan* 2142! C, P. Cathcart district, In sandy spots along the Kabousie Riv., Dec., *Flanagan* 794! A, C: Fairford, Nov., *Cotterrell* 96! A. Herschel district: Sterkspruit, May, *Hepburn* 380! A. Griqualand without locality, Feb., *Tyson* 1376! P in part and Kaffraria without locality, *Cooper* 238! P.

3. **H. Sonderi** Bredell sp. nov., affinis H. aethiopico Thunb. sed foliorum margine haud dentato-glandulo, caulibus plerumque nigro-punctatis differt.

Herba perennis; caules 10–45 cm. alti, pauci vel plures, erecti, leviter ramosi, teretes levigati, nigropunctati vel haud- nigropunctati. *Folia* sessilia, 0·5–2·5 cm. longa, 0·3–1·5 cm. lata, oblonga vel late ovata, punctis nigrisve luteis, apice rotundata, nervis prominentibus; nervi tertii plus minusve conspicuosi vel absunt. *Flores* terminales in cymis laxis vel compactis dispositi. *Bracteae* 3–8 mm. longae, 1·5–2 mm. latae, ovatae vel lineari-lanceolatae, acutae. *Sepala* 4·5 8 mm. longa, 1·5–3 mm. lata, lineari-lanceolatae, acuta, nigro-punctata. *Petala* 0·8–1·5 cm. longa, 2–6 mm. lata, oblonga vel oblongo-spathulata, nigro-punctata. *Stamina* indefinita, 5–9 mm. longa; filamenta filiformes libera vel basi polydelpha; antherae 0·5 mm. longae nigro-punctatae vel impunctatae. *Ovarium* 2·5–4·5 mm. longum, ovatum, 3-loculare; styli 3, liberi 3–6·5 mm. longi; stigmata capitata.

CAPE PROVINCE.—Aliwal North district: Doctors Drift, *Gerstner* 137! P in part. Matatiele district: Cedarville, on hillside, Nov., *Bandert* 102! A. Griquåland East without precise locality, *Tyson* 1376! C, N.

ORANGE FREE STATE.—Harrismith district: Platberg slopes, in grass, *Putterill* in C 16861!. Bethlehem district: Witzies Hoek, Feb., *Junod* in T 17321!.

BASUTOLAND.—Leribe district: *Dieterlen* 358! C, P; *Phillips* 921! C.

NATAL.—Pinetown district: Isipingo, *Medley-Wood* 12475! T, N; Amanzimtoti, June, *Forbes* 647!; Bothas Hill, Oct., *Medley-Wood* in N 6423!, 8004! C, C 11461! N, P. Camperdown district: *Schlechter* 3270! T, P, A. Pietermaritzburg district: Sept., *Rump* in N 20899! and 20316!. Impendhle district: Impendhle, Nov., *Levett* 83! N; Deepdale, in grass, Feb., *Maurice-Evans* 92! N. Estcourt district: Estcourt, *Mogg* 3516! P in part. Mooi Riv., Meteor ridge, Oct., *Mogg* 3235! P; Giant's Castle, *Symons* 132! T. Umvoti district: Greytown, Nov., *Wylie* in N 21699!. Entojaneni district: Melmoth, Sept., *Forbes* 733! N. Nongoma district: Nongoma, Nov., *Gerstner* in N 22257!. Bergville district: National Park, Drakensberg, Nov., *Oliver* 390! P; Mont-aux-Sources, near Tugela Drift, Nov., *Schweikerdt* 823! T; Tugela Valley, grassland, common, Feb., *Bayer* and *McClean* 212! P; Grantleigh, woody herb, *King* 9! P; grassy slopes, *Galpin* 11426! P. Kliprivier district: Ladysmith, Nov., *Rogers* in T 5146!. New Castle district: Charlestown, Boscobello, Jan., *Jenkins* in T 12486!. Utrecht district: Riversmoor, Viljoensdrift, Jan., *Parkhouse* in P 21064!; *Wahl* in T 15386!; grassy places, Spitzkop, Emangweni, Oct., *Thode* in Herb. Univ. Stellenbosch 9326! and in A.

SWAZILAND.—Hlatikulu district: Hlatikulu, *Stewart* 146! C, T.

TRANSVAAL.—Piet Retief district: Grassy slopes, Oct., *Galpin* 9638! P; *Jenkins* in T 10953!. Wakkerstroom district: Jan., *Beeton* 208! C; Dec., *van Dam* in T 24642!; Ermelo district: Spitskop, Dec., *Pott* 5100! T. Carolina district: Dec., *Rademacher* in T 7470!. Barberton district: Plastron, Oct., *Holt* 74! P; on summit, Saddleback Mts., southern slopes, Oct., *Galpin* 1116! A; *Galpin* 1028! G. Belfast district: Machadodorp, grassy fields, Nov., *Galpin* 12522! P; *Jenkins* in T 10301!; Rietvlei, Crocodile Riv., June, *Smuts* 29! P; Waterval Boven, Nov., *Rogers* 18396! P; Waterval Onder, Jan., *Jenkins* in T 6760!. Johannesburg district: Dec., *Leendertz* 1737! T; *Hutton* in A 1039!. Ventersdorp district: Goedgedacht, Dolomite Fountain in black loam, occasional *Sutton* 502! P. Rustenburg district: Vlakfontein, 10 miles west of Koster in red loam, Feb., *Liebenberg* 170! P. Pretoria district: Ashbury Fountains, Nov., *Smith* 1381! P; Koedoespoort, *Smith* 1529! P; on banks of Aapies Riv., near zoo, *Smith* 207! P; Derdepoort, Feb., *Quin* in P 12953!; near stream, occasional, straight stem from underground rootstock, Dec., *Verdoorn* 16! P; Fountains Valley, in grass on east side of magnetite koppie, Nov., *Verdoorn* 580! P; Waterkloof in valley near stream, Jan., *Verdoorn* 77! C, P; Wolwekloof, western hillside, Feb., *Mogg* 15929! P; Aapies River, *Rehmann* 4350! P; Meintjeskop, Feb., *Burtt-Davy* 3958! P; small shrub, with straight stems from an underground rootstock,

Oct., *Phillips* 3038! A, P; south-western slopes of Wonderboompoort, Nov., *Pole Evans* 63! P; Fountains Valley, *Repton* 65! P; *Leendertz* 221! T in part, in T 3734! and T 4173!; Nov., *Forbes* 810! N. Lydenburg district: Farm Swagershoek, very common, Jan., *Obermeyer* in T 27901!. Pilgrims Rest district: Mauchsberg, Sabie, Dec., *Smuts* and *Gillett* 2320! P; Olifants River, *van Niekerk* in T 7561!. Pietersburg district: Woodbush, Mountain Home Farm, Dec., *Mogg* 14711! P; Duiwelskloof, in slopes of valley in burnt veld, July, *Galpin* 9401! P. Zoutpansberg district: Growing on hillsides, Pigeon Hole, Oct., *McCallum* 17! P; ravines, dry places, Feb., *Junod* 4288! P, T. Transvaal without precise locality *Pocock* 36! A.

H. Sonderi Bredell *var. transvalense* Bredell var. nov. Folia membranacea infra prominente lepidota supra et infra reticulata nervis tertiis conspicuis.

TRANSVAAL.—Pietersburg district: Woodbush, Mountain Home Farm, erect "herb", common in moist places in grassland, Dec., *Mogg* 13996! P; Shiluvane, *Junod* 4290! T, P. *Wager* in T 7223! without locality, in part.

4. **H. Wilmsii** Rob. Keller in Bull. Herb. Boiss. Ser. II. VIII: 179 (1908).

Semiherbaceous, less than 20 cm. high. *Stems* many from a persistent tap root, more or less procumbent, branched, round and smooth, glabrous. *Leaves* sessile, 0·5–1·5 cm. long, 0·2–0·6 cm. broad, elliptic-oblong, rounded at the apex, entire, 1- to 3-nerved; tertiary ventation inconspicuous or absent. *Flowers* in few-flowered cymes at the end of the branches. *Bracts* leaf-like, obtuse. *Sepals* 4·5–6 mm. long, 1·5–2·5 mm. broad, oblong, rounded at the apex, distinctly veined with black dots along the margins and yellowish spots on the surface. *Petals* 5–8 mm. long, 2–2·5 mm. broad, oblong to oblong-spathulate, sparsely black-dotted along the margins near the apex. *Stamens* indefinite, usually less than 30; filaments threadlike, free or connate at the base into a few irregular groups, 4–5 mm. long; anthers 0·25–0·5 mm. long, each with a black dot. *Ovary* 2·5–4 mm. long, ovate in outline, 4-chambered; styles 4 or very occasionally 3, free, 1·5–2 mm. long; stigmas capitate.

CAPE PROVINCE.—Murraysburg district: *Tyson* 413! A. Queenstown district: Mountain sides, Nov., *Galpin* 1629! P. Aliwal North district: Elandshoek, moist ground near water course, Oct., *Bolus* 153! C, P; Doctors Drift, *Gerstner* 137! P, in part. Herschel district: Majubanek, near Sterkspruit, Dec., *Hepburn* 92! A.

BASUTOLAND.—Mafeteng district: Slope of Ha-Muya-pela Mt., Likhoele, Jan., *Dieterlen* 1222! P; bank of Catai Riv., Ha-Ma-Khonofane, Nov., *Dieterlen* 1293! P.

TRANSVAAL.—Lydenburg district: Near town, Jan., *Wilms* 136! (fragment of the type in P).

5. **H. natalense** Wood & Evans in Journ. Bot. XXXV: 487 (1897); Engl. & Prantl., Nat. Pflanzenfam. ed. 2, XXI: 177 (1925); Burtt Davy, Flow., Pl. and Ferns of the Transv. and Swaziland 1, 251 (1926) *H. Woodii* Rob. Keller in Eng. Jahrb. LVIII: 193 (1923).

Semiherhaceous, 15–40 cm. high. *Stems* 1 to many from a persistent underground rootstock, erect, much branched, round and smooth, glabrous. *Leaves* sessile, 0·5–2 cm. long, 0·3–1·5 cm. broad, elliptic to oblong-elliptic, rounded at the apex, entire, 3- to 7-nerved; tertiary venation distinct, with the meshes small and punctate. *Flowers* terminal. *Bracts* leaf-like, obtuse. *Sepals* 4·5–7 mm. long, 1·5–4 mm. broad, oblong to oblong-spathulate or obovate, rounded at the apex, distinctly veined, densely dotted with yellowish spots. *Petals* 5–9 mm. long, 2·5–3·5 mm. broad, oblong to oblong-spathulate, distinctly veined with occasional black spots along the margins near the apex. *Stamens* indefinite, 3·5–7 mm. long; filaments threadlike, free or connate at the base into 3 or 4 irregular groups; anthers 0·25–1 mm. long, each with a black dot. *Ovary* 2·5–4 mm. long, ovate in outline, 3-, 4- or 5-chambered; styles 3, 4 or 5, free, 2–3 mm. long; stigmas capitate.

Cape Province.—Kentani district: Damp valleys, Oct., *Pegler* 117! A, P in part. Tsolo district: *Payne* 14! A.

Natal.—Pietermaritzburg district: Balgowan, Oct., *Mogg* 5610! P; April 3809! P; Allerton, Dec., *Mogg* 6567! P. Lions River district: Howick Falls, Nov., *Rogers* in T 5212!; St. Ives, Dargle Road, Oct., *Mogg* 5679! P. Estcourt district: Near bank of Mooi River, Oct., *Medley-Wood* 4034! N, A. Umvoti district: Greytown, Oct., *Wylie* in N 21576!, in N 21577!, in N 22378! and in T 34129!.

H. natalense W. & E. var. *petiolatum* Bredell var. nov. Folia petiolata obovata; petioli 0·5–1 mm. longi.

Natal.—Camperdown district: *Franks* in N 12968!.

6. **H. leucoptychodes** Steudel ex Richard in Tent. Fl. Abyss. 1: 96 (1847); Engl. & Prantl. Nat. Pflanzenfam. ed. 2, XXI: 176 (1925); Journ. Bot. LXV: 330 (1927). *H. lanceolatum* Lam. ex Oliver in Fl. Trop. Afr. 1: 156 (1868); Burtt Davy in Fl. Pl. and Ferns of Transv. and Swaziland 1: 251 (1926) and of Hutchinson and Dalziel in Fl. West. Trop. Africa 1: 230 (1927).

Woody shrub, 4–8 ft. high. *Stems* much-branched, round or almost so, glabrous; internodes very short. *Leaves* sessile, 1·5–3 cm. long, 0·3–0·9 cm. broad, narrowly lanceolate, sub-acute, narrowed towards the base; venation regularly but sparsely pinnate; the tertiary venation somewhat conspicuous and often having the effect of small striae. *Flowers* large and terminal. *Bracts* 0·4–1·5 cm. long, 3–7 mm. broad, ovate to ovate-lanceolate, acute or obtuse. *Sepals* 6–9 mm. long, 3·5–6 mm. broad, ovate to broadly-ovate, obtuse, with minute stalked protuberances on the margins. *Petals* 1·6–3·7 cm. long, 0·5–1·5 cm. broad, oblong-spathulate, distinctly veined and occasionally with stalked bodies along the margins. *Stamens* indefinite, 0·8–1·5 cm. long, filaments thread-like, connate at the base into 5 very distinct groups opposite the petals; anthers 0·5–1 mm. long, occasionally with yellow gland-like bodies between the thecae. *Ovary* 4–8 mm. long, ovate to broadly ovate in outline, 5-chambered; styles 5, 5–9 mm. long, connate almost to the tip, with the free branches 1·5–2 mm. long; stigmas capitate.

Cape Province.—Umzimkulu district: Edge of Malowe forest, near Clydesdale, March, *Tyson* 3044! T, C, P.

Natal.—Richmond district: Richmond, May, *Medley-Wood* 1995! N. Nkandhla district: Qudeni Forest, *Sim* 2942! N; *Govt. Forester* in Forest. Dept. Herb. 8637!; *Kotze* 113! P; *Gerstner* in N 23007!.

Swaziland.—Mbabane district: Jan., *Rogers* 11483! A, P.

Transvaal.—Barberton district: *Thorncroft* 342! P and in T 3929!; banks of streams upper Moodies and also Devil's Kantoor, *Galpin* 658! C, A, P; Kaapsche Hoop, shrub, whole plant strongly scented, Oct., *Thode* 1565! N; Dec., *Gilmore* 2248! P. Lydenburg district: *Schlechter* 3942! A, C, N, P, T; farm Swagershoek, Jan., *Obermeyer* 238! T; on bank of stream and edge of forest, common, Aug., *Keet* 1108! P; Sabie Falls in kloof and along streams, June, *Burtt Davy* 442! P, N. Pietersburg district: Haenertsburg, *van der Merwe* in P 21060!; *Murray* 730! P; *Corlett* 142! P; Broederstroom farm, Nov., *Hodgson* in P 11416!; Magoebaskloof, March, *Potts* 3652! P; *Pole Evans* in P 21061!; New Agatha, June, *McCallum* in P 21060!; Woodbush, Kratzenstein, July, *Hoffman* 98! T; *Jenkins* in T 7181!; *van Dam* in T 25632!. Zoutpansberg district: Ntabini Forest, near Louis Trichardt, June, *Galpin* 10314! P; Nov., *Obermeyer* 1124! T; Laastgevonden, growing along rivers where the soil is damp, Sept., *Koker* 18! P; Cyprus Poin, edge of woods, *Junod* 4207! P.

Southern Rhodesia.—Inyananga: Common, *Henkel* 2568! P. Umtali: July, *Pardy* 5105! P. Stapleford, Oct., *Rattray* 126! P.

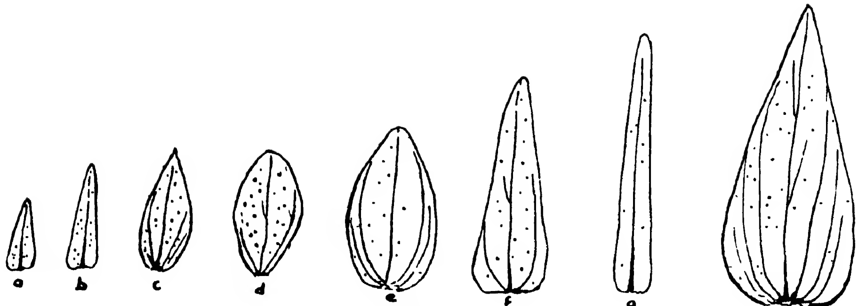
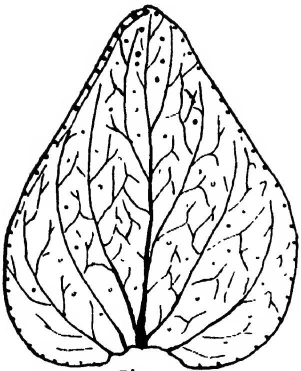


Fig 1.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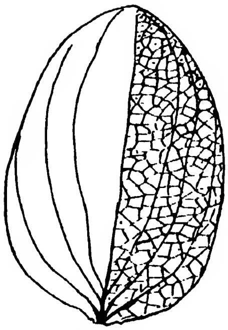
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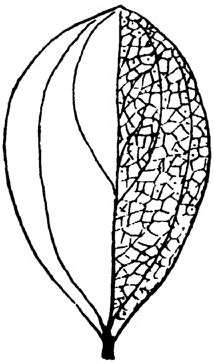
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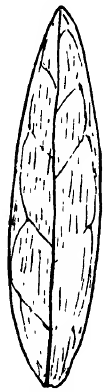
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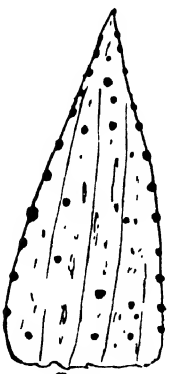
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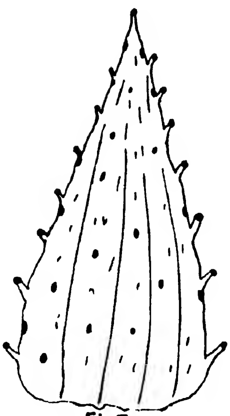
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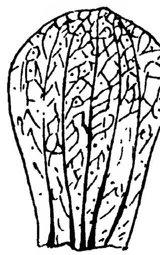
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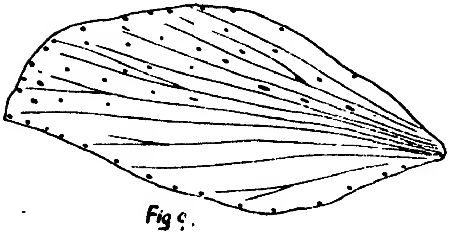
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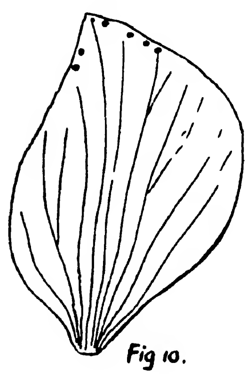
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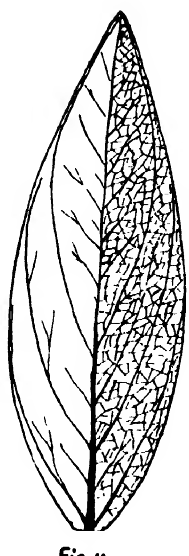


Fig 11.

7. **H. Roeperianum** Schimper in Tent. Fl. Abyss. 1: 96 (1847); Engl. & Prantl., Nat. Pflanzenfam. ed. 2, XXI: 176 (1925); Journ. Bot. LXV: 331 (1927). *H. Quartinianum* Rich. ex Oliver in Fl. Trop. Africa 1: 156 (1868).

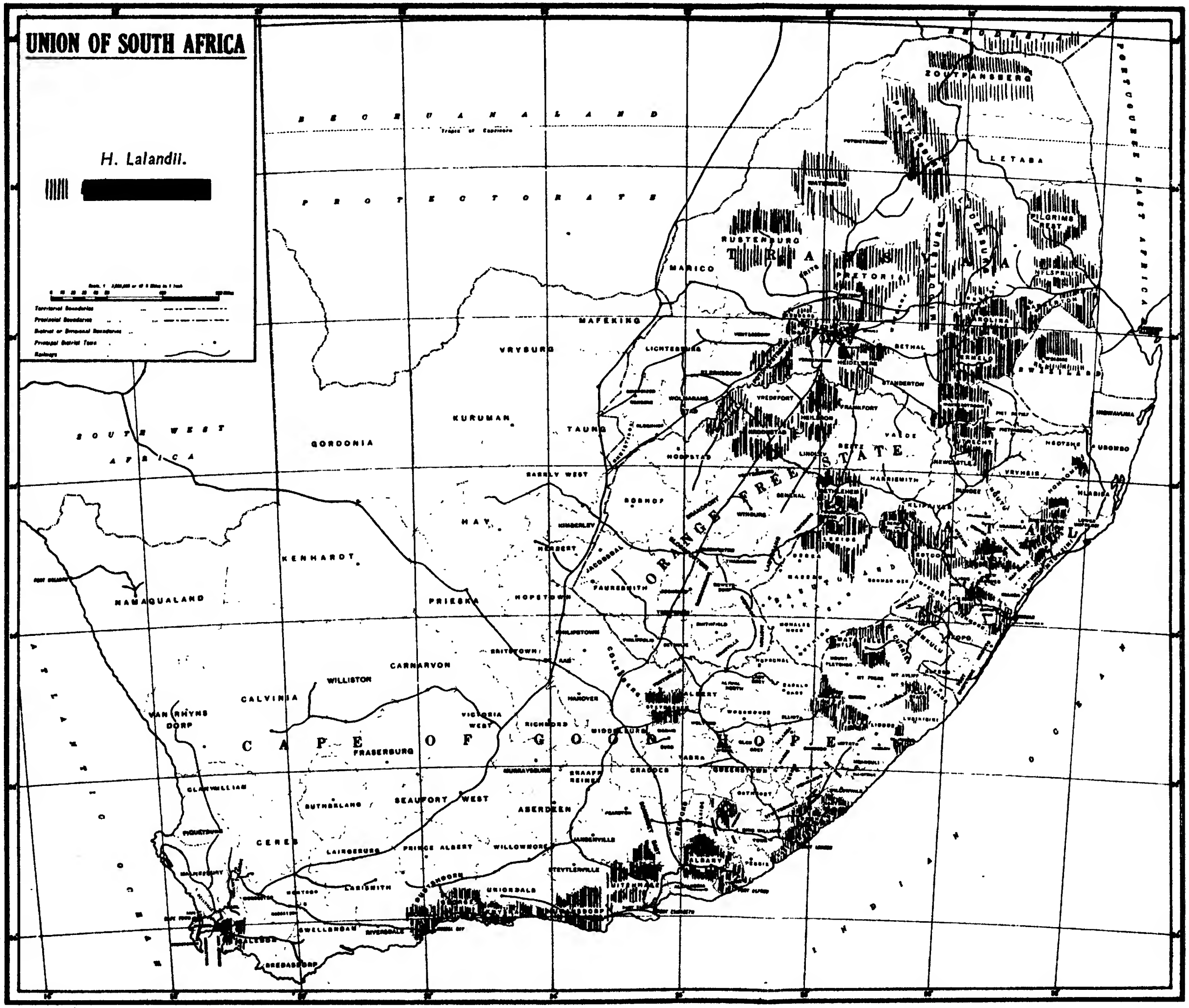
Woody shrub, 5–12 ft. high. *Stems* erect, slightly branched, almost smooth, glabrous. *Leaves* sessile, 4–7 cm. long, 1·5–2·5 cm. broad, elliptic-lanceolate, obtuse to sub-acute, cuneate at the base, dark on the upper surface, much paler beneath; venation almost reticulated, with the meshes small and punctate. *Flowers* large, terminal. *Bracts* 4·5–7 mm. long, 2·5–3 mm. broad, lanceolate to ovate, obtuse or sometimes acuminate, black-dotted or with gland-like bodies along the margins. *Sepals* 5–6·5 mm. long, 2·5–4 mm. broad, ovate to broadly-ovate, obtuse, with black dots and stripes near the margins and minute stalked bodies along the margins. *Petals* 2–3 cm. long, 1–1·5 cm. broad, oblong-spathulate, partly fleshy, with occasional black dots and stalked gland-like bodies along the margins. *Stamens* indefinite, 1·4–1·7 mm. long; filaments thread-like, connate at the base into 5 distinct groups opposite the petals; anthers 1 mm. long, occasionally with white gland-like bodies between the thecae. *Ovary* 5–6·5 mm. long, ovate to sub-round, 5-chambered; style 1, 0·6–1 cm. long; stigma distinctly 5-lobed.

TRANSVAAL.—Lydenburg district: Mariepskop, Nov., *Fitzsimons* and *van Dam* in T 26311!; April, *van Son* in T 32921!.

SOUTHERN RHODESIA.—Umtali: July, *Pardy* in Govt. Herb., Salisbury 5092! and in P. Odzani Riv. valley, *Teaque* 214! C. Vumba Mts., margins of forest, "Cloudlands", July, *Galpin* 9247! P. Melsetter, June, *Rump* in N 23094!; common shrub, large, showy, June, *Eyles* 795! C.

EXPLANATION OF FIGURES.

Fig. 1, *a–h*, different shapes and sizes of leaves of *H. Lalandii*; Fig. 2, abaxial surface of leaf of *H. aethiopicum*; Fig. 3, abaxial surface of leaf of *H. natalense*; Fig. 4, leaf of *H. natalense* var. *petiolatum*; Fig. 5, abaxial surface of leaf of *H. leucoptychodes*; Fig. 6, sepal of *H. Sonderi*; Fig. 7, sepal of *H. aethiopicum* showing the stalked gland-like protuberances along the margins; Fig. 8, sepal of *H. natalense* and *H. Wilmsii*; Fig. 9, petal of *H. aethiopicum*; Fig. 10, petal of *H. natalense* and *H. Wilmsii*; Fig. 11, abaxial surface of leaf of *H. Roeperianum*.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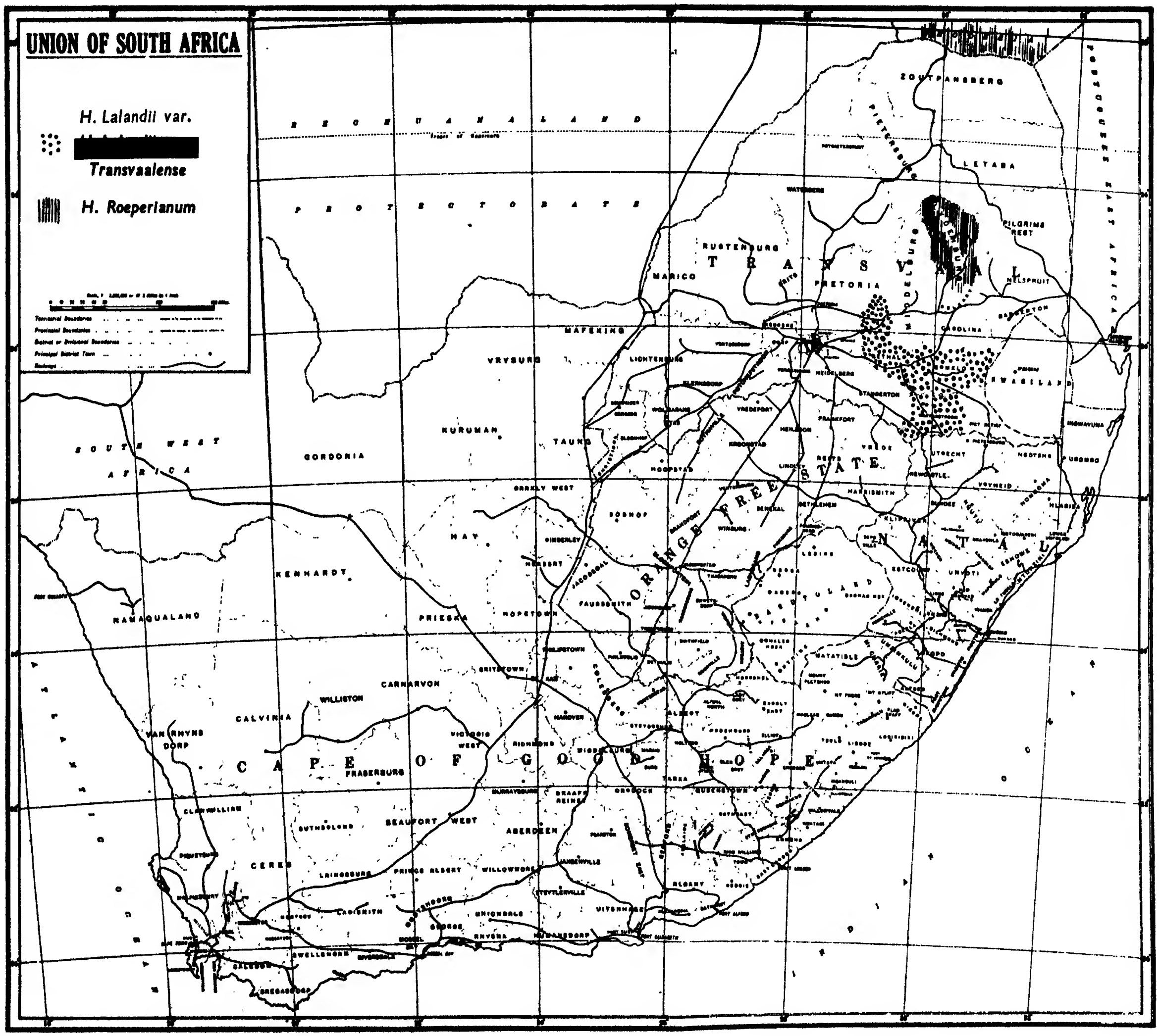
H. Lalandii.
BECHUANALAND
PROTECTORATE
SOUTH WEST AFRICA
PORTUGUESE EAST AFRICA
TRANSVAAL
ORANGE FREE STATE
NATAL
CAPE OF GOOD HOPE
ATLANTIC OCEAN
INDIAN OCEAN
ZOUTPANSBERG
LETABA
PIETERSBURG
WATERBERG
RUSTENBURG
PILGRIMS REST
MARICO
PRETORIA
MAFEKING
BETHAL
VRYBURG
LICHTENBURG
KURUMAN
TAUNG
GORDONIA
HEIDELBERG
STANDERTON
FRANKFORT
VREDEFORT
BARKLY WEST
BOSHOF
HAY
KENHARDT
HERBERT
FAURESMITH
NAMAQUALAND
PRIESKA
HOPETOWN
PHILIPSTOWN
BRITSTOWN
CARNARVON
WILLISTON
CALVINIA
VAN RHYNS DORP
VICTORIA WEST
RICHMOND
HANOVER
COLESBERG
MIDDELBURG
FRASERBURG
MURRAYSBURG
GRAAFF REINET
CRADOCK
TARKA
QUEENSTOWN
CLANWILLIAM
SUTHERLAND
BEAUFORT WEST
ABERDEEN
CERES
LAINGSBURG
PRINCE ALBERT
WILLOWMORE
JANSENVILLE
STEYTLERVILLE
UNIONDALE
LADISMITH
SWELLENDAM
RIVERSDALE
BREDASDORP
ALBANY
HARRISMITH
VREDE
VRYHEID
NEWCASTLE
UBOMBO
HLABISA
KOKSTAD
SWAZILAND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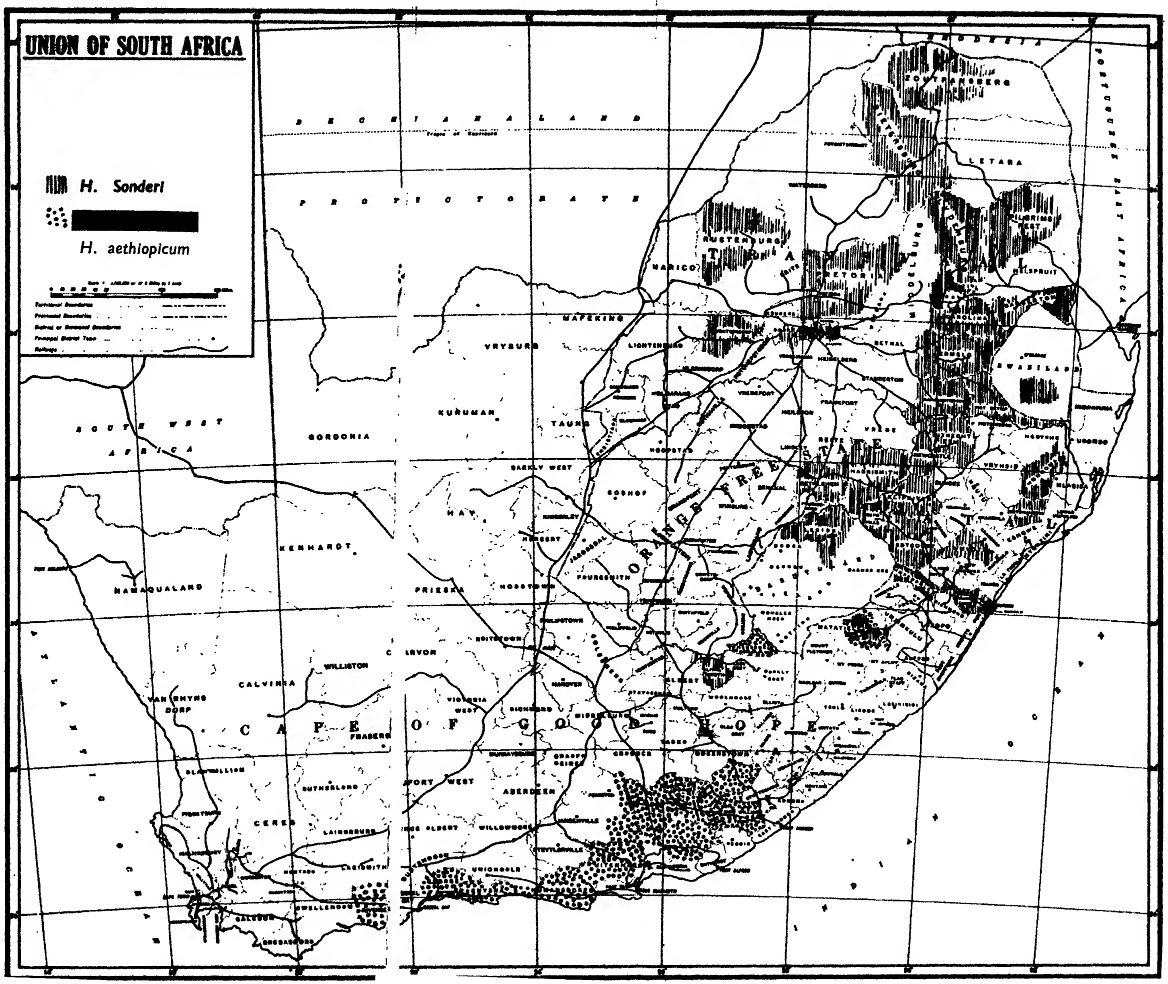
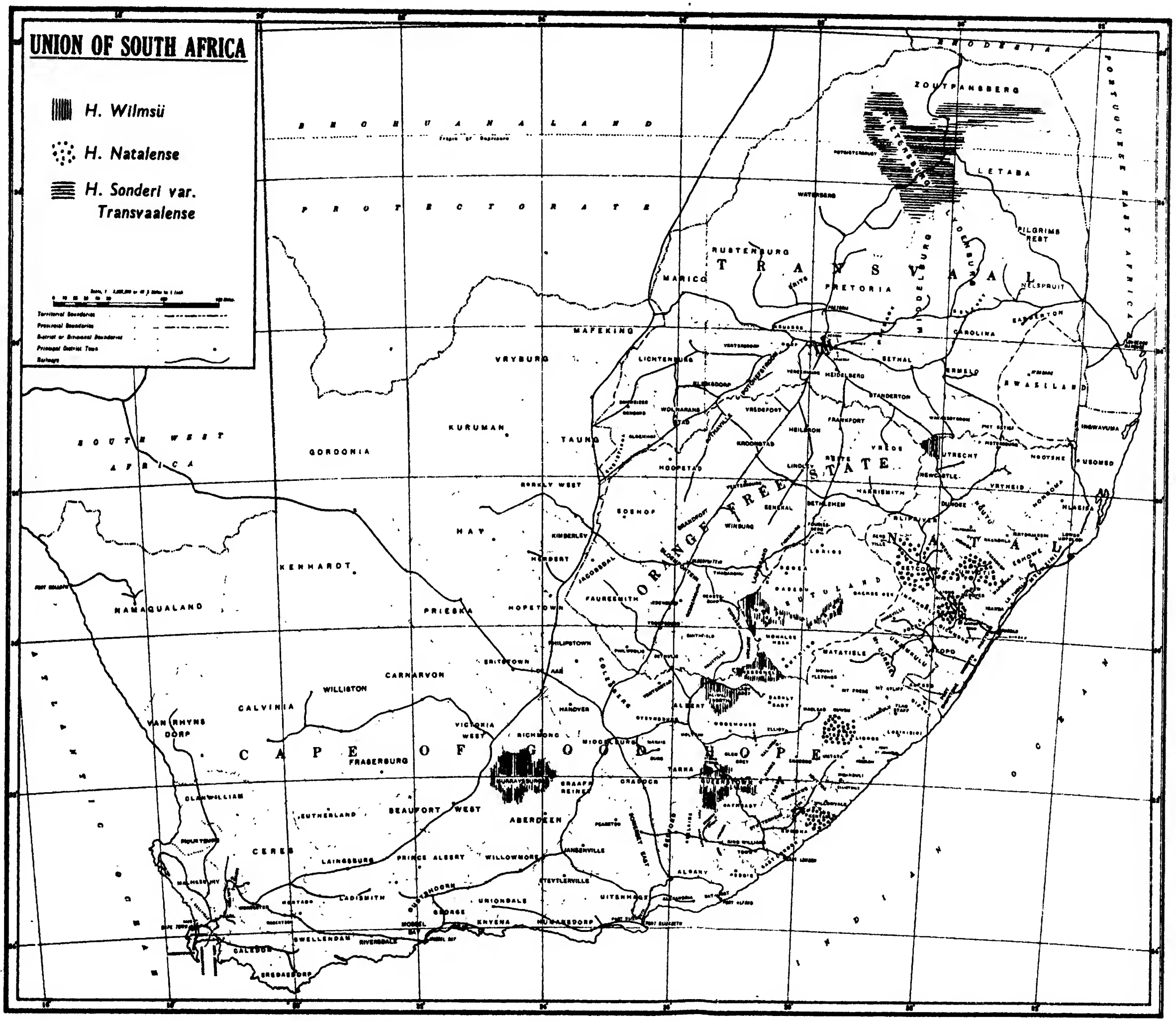
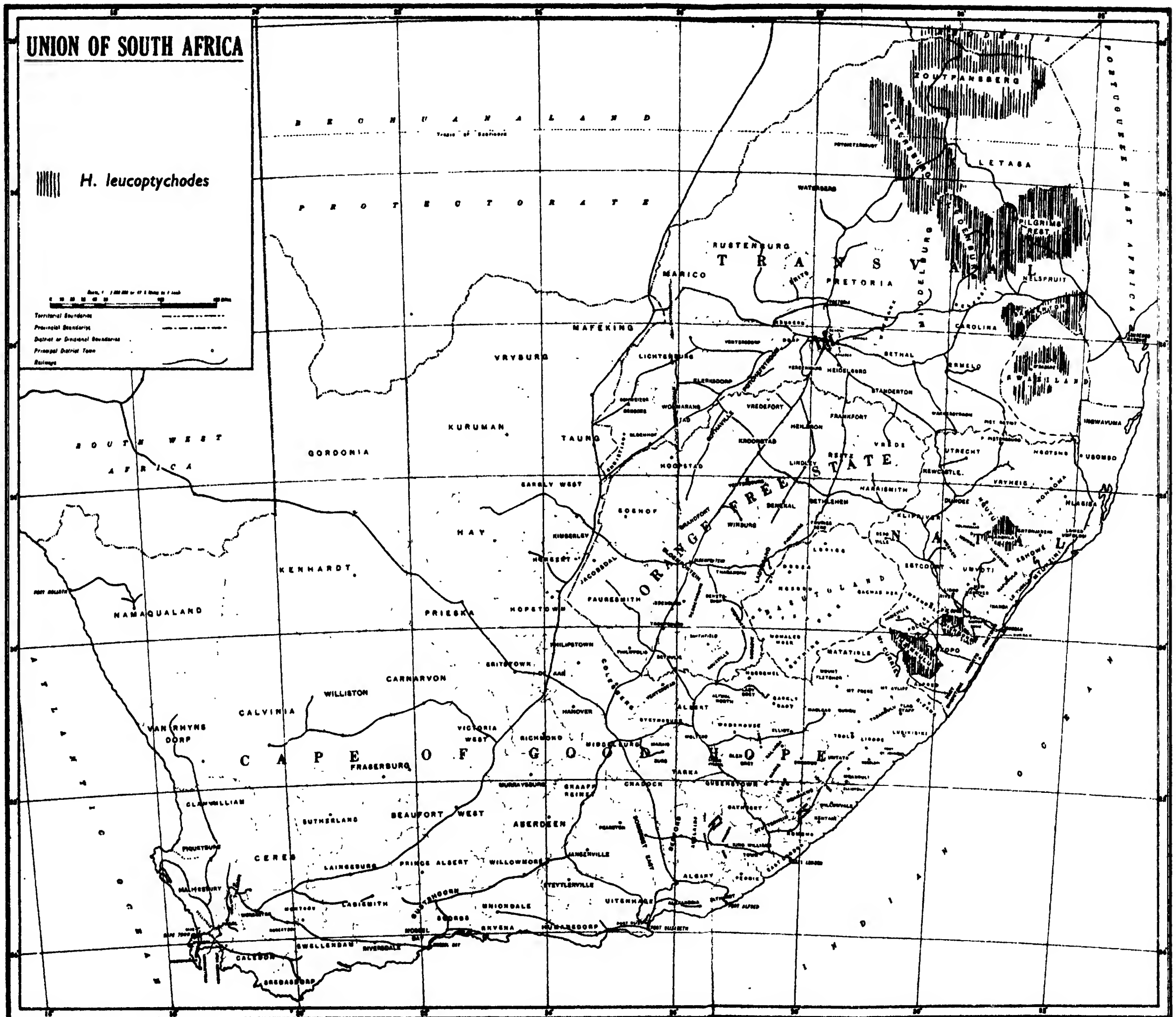
Transvaalense
H. Roeperianum
BECHUANALAND
PROTECTORATE
SOUTH WEST AFRICA
PORTUGUESE EAST AFRICA
TRANSVAAL
ORANGE FREE STATE
NATAL
CAPE OF GOOD HOPE
SWAZILAND
ATLANTIC OCEAN


UNION OF SOUTH AFRICA
H. Sonderi
[redacted]
H. aethiopicum
BECHUANALAND
PROTECTORATE
SOUTH WEST AFRICA
RHODESIA
PORTUGUESE EAST AFRICA
TRANSVAAL
ORANGE FREE STATE
CAPE OF GOOD HOPE
NATAL
BASUTOLAND
SWAZILAND
ATLANTIC OCEAN
INDIAN OCEAN
ZOUTPANSBERG
LETABA
WATERBERG
RUSTENBURG
MARICO
PRETORIA
MIDDELBURG
PILGRIMS REST
MAFEKING
LICHTENBURG
VRYBURG
KURUMAN
TAUNG
GORDONIA
BARKLY WEST
BOSHOF
HAY
HERBERT
KENHARDT
NAMAQUALAND
FRIESKA
HOPETOWN
PHILIPSTOWN
FAURESMITH
CARNARVON
WILLISTON
CALVINIA
VAN RHYNS DORP
FRASERBURG
BEAUFORT WEST
ABERDEEN
CERES
LAINGSBURG
SUTHERLAND
CLANWILLIAM
PRINCE ALBERT
WILLOWMORE
UNIONDALE
CALEDON
BREDASDORP
SWELLENDAM
BETHAL
STANDERTON
HEIDELBERG
FRANKFORT
VREDE
BETHLEHEM
HARRISMITH
VRYHEID
UBOMBO
INGWAVUMA
NGOTSHE
GRAAFF REINET
CRADOCK
QUEENSTOWN
MIDDELBURG
STEYTLERVILLE
TARKA


UNION OF SOUTH AFRICA
H. Wilmsii
H. Natalense
H. Sonderi var. Transvaalense
BECHUANALAND PROTECTORATE
SOUTH WEST AFRICA
TRANSVAAL
ORANGE FREE STATE
NATAL
CAPE OF GOOD HOPE
BASUTOLAND
SWAZILAND
PORTUGUESE EAST AFRICA
RHODESIA
ATLANTIC OCEAN
INDIAN OCEAN
ZOUTPANSBERG
LETABA
PILGRIMS REST
RUSTENBURG
MARICO
PRETORIA
WATERBERG
MAFEKING
VRYBURG
KURUMAN
TAUNG
GORDONIA
KENHARDT
NAMAQUALAND
HAY
PRIESKA
HOPETOWN
KIMBERLEY
HERBERT
BOSHOF
CARNARVON
WILLISTON
CALVINIA
VAN RHYNS DORP
CLANWILLIAM
FRASERBURG
SUTHERLAND
BEAUFORT WEST
CERES
LAINGSBURG
PRINCE ALBERT
WILLOWMORE
ABERDEEN
GRAAFF REINET
CRADOCK
MIDDELBURG
RICHMOND
VICTORIA WEST
BRITSTOWN
PHILIPSTOWN
HANOVER
COLESBERG
ALBERT
QUEENSTOWN
TARKA
ALBANY
UITENHAGE
JANSENVILLE
STEYTLERVILLE
UNIONDALE
LADISMITH
OUDTSHOORN
GEORGE
KNYSNA
HUMANSDORP
MOSSEL BAY
SWELLENDAM
RIVERSDALE
CALEDON
BREDASDORP
FAURESMITH
JACOBSDAL
WINBURG
KROONSTAD
HEILBRON
FRANKFORT
VREDE
HARRISMITH
BETHLEHEM
LINDLEY
HOOPSTAD
LICHTENBURG
HEIDELBERG
STANDERTON
BETHAL
ERMELO
CAROLINA
BARBERTON
NELSPRUIT
LYDENBURG
MIDDELBURG
UTRECHT
NEWCASTLE
VRYHEID
DUNDEE
NONGOMA
ESHOWE
INGWAVUMA
USUTU
MATATIELE
UMTATA


UNION OF SOUTH AFRICA
H. leucoptychodes
Territorial Boundaries
Provincial Boundaries
District or Divisional Boundaries
Principal District Town
Railways
BECHUANALAND
PROTECTORATE
TRANSVAAL
ORANGE FREE STATE
NATAL
CAPE OF GOOD HOPE
BASUTOLAND
SWAZILAND
SOUTH WEST AFRICA
PORTUGUESE EAST AFRICA
ATLANTIC OCEAN
INDIAN OCEAN
ZOUTPANSBERG
PIETERSBURG
LETABA
WATERBERG
PILGRIMS REST
LYDENBURG
NELSPRUIT
MIDDELBURG
RUSTENBURG
PRETORIA
MARICO
CAROLINA
BETHAL
ERMELO
STANDERTON
HEIDELBERG
LICHTENBURG
MAFEKING
VRYBURG
KURUMAN
TAUNG
GORDONIA
KENHARDT
HAY
BARKLY WEST
KIMBERLEY
BOSHOF
HOOPSTAD
KROONSTAD
VREDEFORT
HEILBRON
FRANKFORT
VREDE
REITZ
LINDLEY
HARRISMITH
BETHLEHEM
WINBURG
SENEKAL
FAURESMITH
JACOBSDAL
HERBERT
HOPETOWN
PRIESKA
PHILIPSTOWN
BRITSTOWN
CARNARVON
WILLISTON
CALVINIA
VAN RHYNS DORP
NAMAQUALAND
VICTORIA WEST
RICHMOND
MIDDELBURG
HANOVER
COLESBERG
ALBERT
FRASERBURG
MURRAYSBURG
GRAAFF REINET
CRADOCK
TARKA
QUEENSTOWN
CLANWILLIAM
PIQUETBURG
SUTHERLAND
BEAUFORT WEST
ABERDEEN
CERES
LAINGSBURG
PRINCE ALBERT
WILLOWMORE
JANSENVILLE
STEYTLERVILLE
MALMESBURY
LADISMITH
OUDTSHOORN
UNIONDALE
UITENHAGE
ALBANY
MOSSEL BAY
GEORGE
KNYSNA
HUMANSDORP
SWELLENDAM
RIVERSDALE
CALEDON
BREDASDORP
UTRECHT
NEWCASTLE
VRYHEID
DUNDEE
KLIPRIVER
ESTCOURT
UMVOTI
ESHOWE
NGOTSHE
UBOMBO
INGWAVUMA
MATATIELE
MOUNT CURRIE
UMZIMKULU
ALIWAL NORTH
WODEHOUSE
BARKLY EAST
SOMERSET EAST
PORT ELIZABETH
PORT NOLLOTH
HLABISA

THREE SPECIES OF STRYCHNOS WITH 1- SEEDED FRUITS.

by

I. C. Verdoorn.

When naming specimens of *Strychnos* with 1-seeded fruits (rarely 2-seeded) sent in by Mr. W. E. Marriott of Durban, a few interesting points came to light. As a consequence it is now possible to define the three species concerned more completely. The specimens were from trees marked Nos. I, II and IV. At first only fruiting material was sent and flowers of Nos. I and II were received later when they developed in November. Unfortunately the flowers of No. IV were not obtained.

In specimen No. I (Fig. 1) the leaves are up to 6 cm. long and 2·5–3 cm. wide, more or less elliptic; buds short, ovate; perianth-tube short, sparsely hairy in the throat; lobes quite glabrous; fruit dark green, oblong, equal-sided at the base; seed shaped like a coffee-bean being deeply channelled down one side and rounded on the other.

Specimen No. II (Fig. 2) has leaves up to 4·2 cm. long and 2·5 cm. broad, more or less obovate; buds oblong; perianth-tube as long as the lobes; lobes distinctly bearded; fruit light green to yellow and reddish, oblong or globose oblique at the base; seed oblong globose, slightly compressed, not channelled down one side.

Specimen No. IV (Fig. 3) has leaves 4–6 cm. long and 2–3·5 cm. broad, ovate, long acuminate, folding along the midrib; upper surface shiny: fruit globose, distinctly stipitate; seed globose, slightly compressed (flowers not seen).

This plant with the stipitate fruit and the long-acuminate, folded leaves did not agree with the description of any known South African species.

With regard to No. I, as far as the leaves and flowers were concerned it appeared to be *S. Henningsii* as described in Fl. Cap. Vol. 4 pt. 1, 1051 (1909). The seed, however, is here described as "globose or ovoid" whereas the coffee-bean-like seed of No. I is very distinctive. To elucidate this point the specimens in all South African herbaria were examined. This showed that leaves, flowers and fruits characteristic of No. I are always correlated with the coffee-bean shaped seed. Such specimens were usually identified as *S. Henningsii*. This species was originally described on leaf characters only and the type specimen is housed in the Berlin Herbarium, Dahlem. Searching other botanical literature for mention of the species it was found in Wood's *Natal Plants* and Sim's *Forests and Forest Flora of the Cape Colony*. In the former the description and drawing of leaves, flowers

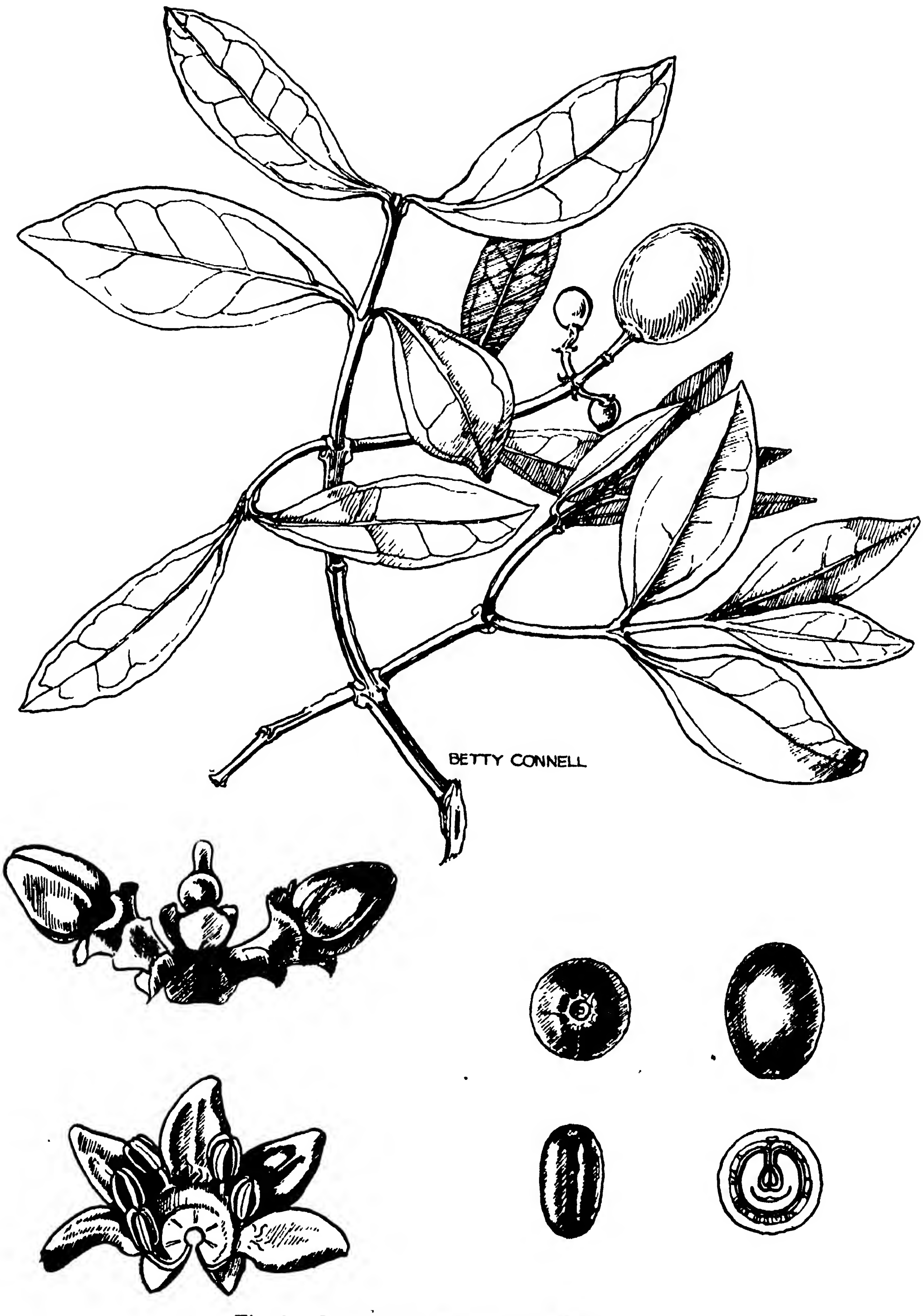


Fig. 1.—*Strychnos Henningsii* Gilg (Marriott I).

Fig. 2.—*Strychnos decussata* (Pappe) Gilg (=*S. Atherstonei* Harv.) (Marriott II).

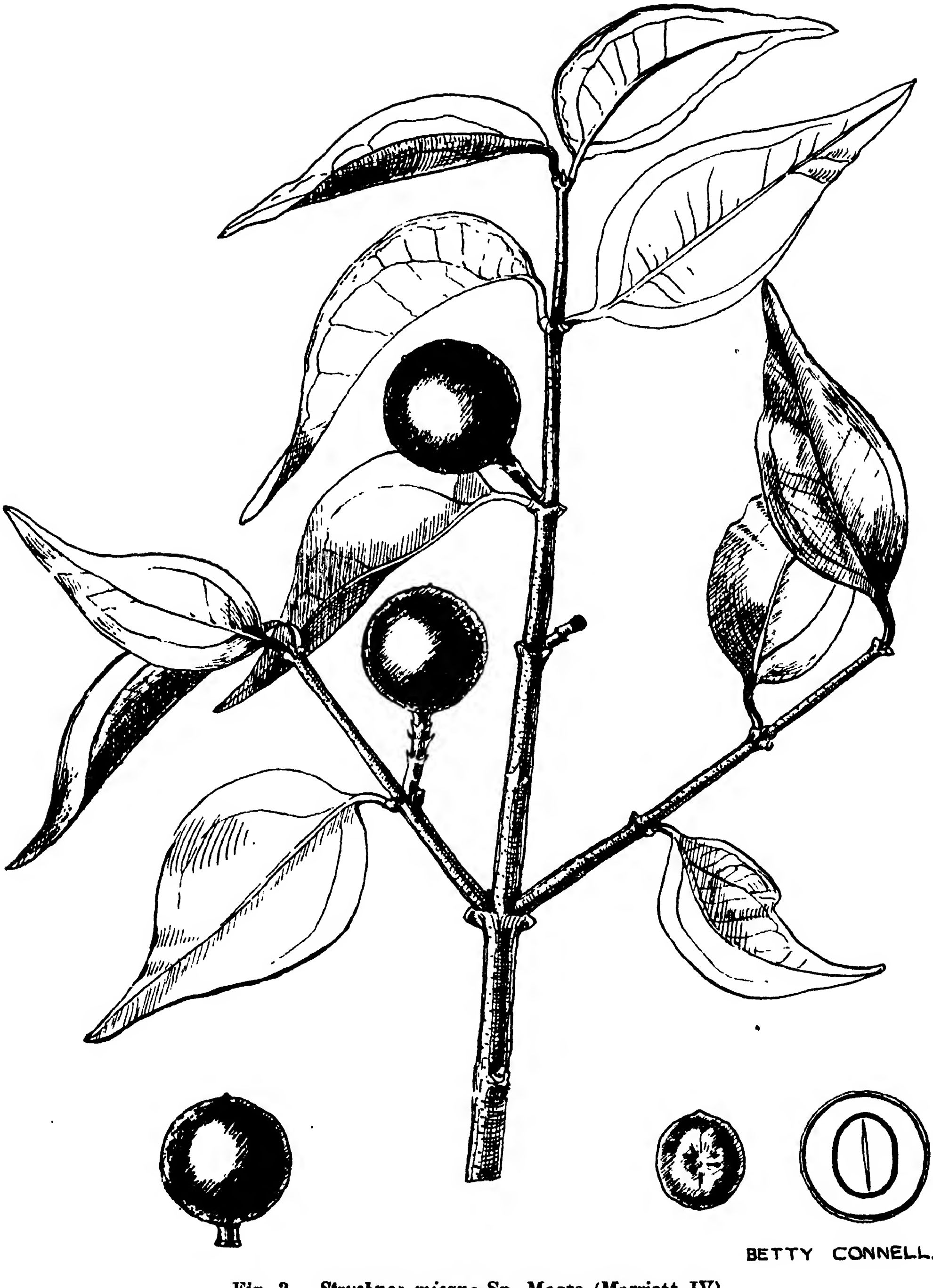


Fig. 3.—***Strychnos micans*** **Sp. Moore (Marriott IV).**

and fruits are those associated with the coffe-bean seed. The seed itself is not figured but is described as " globose " and a note added that only 1 fruit had been seen. In the latter publication for the first time the characteristic seed was clearly figured and described. The figure agrees also in the other characters associated above with such seeds. From this it was concluded that the description of the seed of *S. Henningsii* in the Flora Capensis was inaccurate and that the error was repeated by J. Medley-Wood.

The material of No. I was later taken to the Royal Botanic Gardens, Kew and there, through the courtesy of the Director and the Director of the Botanisches Museum, Berlin-Dahlem, the type material of *S. Henningsii* Gilg (2 leafy specimens collected at Durban) was borrowed. Dr. H. G. Schweickerdt, Botanist for South Africa at Kew, examined those types and reported that the leaves had the general characteristics of those usually placed in *S. Henningsii* (and which had been proved to be correlated with the coffee-bean shaped seed) but were on the whole larger. He matched one or two leaves on the Marriott specimens with those of *Beyrich* I (i.e. one of Gilg's syntypes) and on *Wood* 6672, which is a duplicate of the specimen Medley-Wood described and figured in *Natal Plants*. Dr. Schweickerdt wrote " Leaves marked *a*, *b* and *c* are an excellent match of those on *Beyrich* I ". He noted too that on *Bachmann* 1745 (the other syntype) the collector gives a native name " Umnonono " for the tree and it is the same as mentioned by Medley-Wood. The leaves being on the whole larger can probably be explained by their having been collected when the trees were not in flower or fruit: such leaves often being larger than those found on flowering or fruiting branches. Thus Marriott I can now be named *Strychnos Henningsii* Gilg with some degree of certainty.

Regarding Marriott No. II, according to floral characters given in the *Flora Capensis* this is *S. Atherstonei* Harv. It agrees well with the type description and figure in Harvey's *Thesaurus Capensis*. The seed as mentioned above is oblong-globose, slightly compressed and with no sign of the longitudinal channel, only a slight indentation in the centre of one of the slightly flattened surfaces (the mark of the hilum or attachment). The drawing of the seed in the type plate is accurate and the description " peltate " is used in the botanical sense meaning " attached by the surface ". Through the courtesy of Prof. H. H. Dixon of Trinity College, Dublin, I was enabled to examine photographs of the material which Harvey had worked on and these supported the above identification. In studying Harvey's notes, however, it is evident that, according to the international rules of nomenclature, the specific epithet must be changed. Prior to Harvey's work Pappe described a plant *Atherstonea decussata*. Harvey, when describing *Strychnos Atherstonei* cites this name in the synonymy of his species saying that he could not find any tangible character on which to separate the plant generically from *Strychnos*. There is no doubt that Pappe's plant is the same species as Harvey's and since the first valid specific epithet must be used it is necessary to employ the combination *Strychnos decussata* (Pappe) Gilg, published in *Engl. Bot. Jahrb.* 28, 121 (1901). Marriott No. II therefore is named as such.

Dealing now with Marriott No. IV which, as mentioned, does not agree with any description of a South African species, it was matched in Pretoria with fruiting specimens collected in the Hlatikulu Forest (*Boocock in National Herbarium* 23199). Later it was matched at Kew with unnamed fruiting specimens from tropical Africa (*Swynnerton* 1071 from Chirinda Forest and *Dawe* 531 from the Kibala Forest). These 4 specimens possessing stiped fruits also have similar leaves which are long-acuminate, shiny on the upper surface and have a tendency to fold along the mid-rib. A further search through the material of *Strychnos* at Kew brought to light a young flowering specimen (*Swynnerton* 125) which also has these characteristic leaves. It is the type of *Strychnos micans* Sp. Moore. The characters and the locality seem to point to its being conspecific with the other specimens mentioned. The description disclosed another character which supports this opinion. The flowers of *S. micans* are described as being 4-merous (most other species are 5-merous in this genus) and the remains of the calyx on all the fruits showed 4 distinct lobes. It seems

justified to assume, therefore, that Marriott IV is *Strychnos micans* Sp. Moore, and if this is so the distribution records of the species have been considerably amplified. The following table summarises the distinguishing characters of the three species investigated :—

STRYCHNOS HENNINGSII *GILG*	**S. DECUSSATA** (*PAPPE*) *GILG* (*S. Atherstonei* Harv.).	**S. MICANS** *SP. MOORE*
Fruit oblong-ovoid, not oblique at base, not stipitate ; seeds oblong-ovoid, deeply grooved down one side ; hilum midway in groove.	Fruit globose or ovoid, oblique at the base, not stipitate ; seeds ovoid, slightly compressed ; hilum in centre of slightly compressed surface.	Fruit globose, not oblique, stipitate ; seeds globose, slightly compressed ; hilum in centre of slightly compressed surface.
Leaves up to 6 cm. long and 2·5–3 cm. wide, elliptic, widest about the middle and gradually narrowing to the apex or somewhat acuminate ; tertiary veins obvious on upper surface.	Leaves up to 4·2 cm. long and 2·5 cm. wide, obovate, widest above the middle, rounded at the apex or widely and bluntly acuminate ; tertiary veins not obvious on upper surface.	Leaves up to 6 cm. long and 2–3·5 cm. wide, ovate, long acuminate, widest below the middle, long accuminate folding along the mid-rib ; tertiary veins usually obvious.
Flowers 5-merous ; corolla-tube glabrous or sparsely bearded in throat ; lobes glabrous.	Flowers 5-merous, corolla-tube glabrous ; lobes densely bearded within.	Flowers 4-merous, corolla-tube bearded in throat ; lobes glabrous.

THE FLORA OF TRISTAN DA CUNHA: H.M.S. CARLISLE EXPEDITION, 1937.

By R. A. Dyer.

Through the courtesy of the British Admiralty, the Union Government was invited early in 1937 to nominate a meteorologist and a botanist to join an expedition to Tristan da Cunha on H.M.S. Carlisle.

The main objects of the expedition were to make a record of conditions in general on the island, with particular reference to the health and teeth of the islanders, to take provisions and mail to the islanders, and to bring away on holiday the Rev. H. Wilde, who had served on the island for three years. During the past 100 years various scientific expeditions have visited the Tristan group of islands, but none made a very lengthy stay. The 1937 visit of H.M.S. Carlisle was no exception in this respect.

Acknowledgments.

The presence of a botanist in the expedition was due indirectly to a suggestion by Mr. P. A. Snell, informally referred to as the Ambassador for Tristan da Cunha at Cape Town. I am personally indebted to Dr. I. B. Pole Evans and Dr. E. P. Phillips for my nomination as botanist. There was scarcely a month in which to prepare for the trip and at the time of notification I had very little knowledge about the Island. I am especially grateful to Captain Marrick, the officers and several members of the company of H.M.S. Carlisle for assistance in various respects which made my efforts more profitable than they may well have been in the circumstances. In view of the opinion of the officers that unusually fine weather was experienced *except for a small gale*, I may state, in part defence of my results, that I was not born to the sea.

The Director of the South African Museum, Capetown, allowed me, with the assistance of Miss S. Garabedian, to consult the botanical specimens collected on Tristan da Cunha by Messrs. Bonomi and Kaytel, and later the Director forwarded on loan to Pretoria important literature. The Director, Royal Botanic Gardens, Kew, arranged for the comparison of my material with the Kew collection and put me in touch with Mr. H. N. Dixon, who has very kindly supplied a complete report on the mosses. The assistance of these and several of my colleagues is greatly appreciated. I shall refer later to the invaluable aid rendered by the islander Arthur Rogers.

A large number of duplicates of the botanical specimens collected on the expedition has been distributed to the more important oversea herbaria, the Royal Botanic Gardens, Kew, having been presented with the first set.

Recapitulation.

Tristan da Cunha is the largest of a small group of islands of volcanic origin in the centre of the South Atlantic Ocean just south of the latitude of the Cape of Good Hope and about 2,000 miles distant from it. It was discovered in 1506 by a Portuguese Admiral who gave it his name. Inaccessible Island and Nightingale Island are within a radius of about 16 miles. Tristan da Cunha is roughly 21 miles in circumference and 6,500 feet

high. Except for the present settlement plateau, ½–1 mile wide and 50-100 feet in altitude, the island rises precipitously from the sea to an altitude of between 2,000 and 3,000 feet; thence upwards to the summit the rise is more gradual. Vegetation practically ceases above 4,000 feet, due to the lack of soil. The peak of the island is rarely seen owing to the presence of mist almost throughout the year. The rainfall is well distributed and although no exact data are available, the total annual fall must be anything between 50–100 inches on the settlement plateau.

Although over 300 years elapsed after its discovery in 1506 to the date from which permanent colonisation took place, the Tristan group of islands had been the home of various shipwrecked sailors for short periods during the long interval.

The flora of Tristan da Cunha was investigated first in January, 1793 by Aubert du Petit Thouars during a five days' call for watering on the way to the Mascarene Islands. He published his results in 1811 in two papers, " Description abregèe des isles de Tristan d' Acugna " and " Esquisse de la flore de l'isle de Tristan d'Acugna " being parts of his " Melanges de Botanique et de Voyages." This was followed by an excellent account in 1818 by Captain Dugald Carmichael who landed on the island in 1816. He had the advantage of a longer stay than Thouars and his account of the vegetation serves as a reliable basis for comparison with present-day conditions.

H. N. Moseley, Naturalist to the H.M.S. Challenger expedition (1873–76) published what may be looked upon as an interim report on the flora in 1875. MacGillivray and Milne collected earlier in 1852 but their report was not published. Hemsley, in 1885, reviewed the data accumulated up to that date with particular reference to Moseley's report.

Subsequent to this, Gane, Bonomi (1904) and Keytel collected botanical specimens; those of Keytel gathered 1908–1909 were the basis of a paper by Phillips, 1913. The first set of both Bonomi's and Keytel's specimens are in the South African Museum, Capetown. The Report in 1912 on the S.Y. Scotia expedition, 1902–4, which called only at Gough Island, 220 miles to the south, added a little to our knowledge. The botany of the island is mentioned also by Macklin as a result of the visit in 1922 of the " Quest " on Shackleton's last voyage, and by Mrs. Rogers, wife of Rev. Rogers, missionary on the island, 1922–25.

The most recent publication on the flora of Tristan da Cunha is by Christophersen, 1937, who deals principally with a collection of plants made in 1934 by Einar Siggeson. Dr. Erling Christophersen himself sailed to the Tristan group in November, 1937, in charge of a scientific expedition. Unlike previous expeditions his was planned to extend over a period of several months and should result in the accumulation of most valuable data in connection with controversial subjects such as the origin and main affinities of the flora.

Notes on Origin and Affinities of the Flora.

A brief reference to some of the more important views on the origin and present affinities of the flora may be of interest. Although Sir Joseph Hooker did not land at Tristan da Cunha while engaged on his scientific expeditions in the Antartic about the middle of last century, he considered its flora in the light of Carmichael's results. Dealing with the Antartic flora as a whole, he pointed out in guarded terms that " the many bonds of affinity between the three southern Floras—the Australian, Antarctic and South African—indicate that these may all have been members of one great vegetation, which may once have covered as large a Southern area as the European does a Northern." Referring to the flora of Tristan da Cunha he found that of the 28 flowering plants then recorded only one species of *Phylica* and one *Pelargonium*, amounting to one-fourteenth of the whole, are Cape forms, whilst seven others, or one-quarter of the flora, are either native of Fuegia or typical of South American botany; and the ferns and lycopodia exhibit a still stronger affinity. He further

pointed out that there are some points in which the vegetation of Tristan da Cunha resembles that of St. Helena and Ascension. This is through the *Phylica* sp. and *Pelargonium* sp. which link the flora with that of the Cape also. However, such important families at the Cape as *Proteaceae*, *Rutaceae*, *Oxalidaceae*, *Crassulaceae*, *Ericaceae*, *Restiaceae* are entirely absent from St. Helena, Ascension and the Tristan da Cunha group, which is in marked contrast to the affinity of the South Western Cape flora with that of Australia.

Schonland, when dealing with the subject of the origin of the Angiospermus Flora of South Africa does not mention the flora of the Tristan group specifically. He does, however, make several pertinent remarks when discussing Hooker's work on the Antarctic flora. "The theory which I formulated is briefly this : At the times when these common types developed, probably in Lower Cretaceous times, possibly even in Jurassic times, there was still a direct land connection between Australia and South Africa, that some of these types were carried to South America by a later connection with Australia and that on the other hand Tropical Africa was able to exchange types of animals and plants with Tropical America up to early Tertiary times, and that in this way a second connection between the South African flora and the flora of America was established."

Hemsley, writing earlier, considered that the flora of the Tristan group consists of 3 or 4 distinct elements, " no one of which sufficiently predominates to justify the assumption that it is essentially the original flora—the facts indicate the former existence of a floral region distinct from America and Australia, and, if not African, at least more closely allied to that than to any other." Personally I consider the weight of evidence against Hemsley's conclusion. He himself concedes that there are probably equally weighty facts against it.

Christophersen, while expressing the view that our knowledge of the phanerogams of Tristan da Cunha is insufficient for phytogeographic discussions of any consequence, draws attention to the relatively low number of endemic species, and " the high number of species of South American or/and New Zealand—Australian distribution, as compared with that of South African distribution." Since the expression of these views he has had the advantage of several months' study of the flora on the island and his conclusions are now awaited with interest.

History of Flora since colonisation.

Before giving the results of my work, I propose to recapitulate briefly from the records of Carmichael, Moseley and Macklin in order to trace the changes which have taken place in the indigenous flora of Tristan da Cunha since the first days of permanent colonisation.

Captain Dugald Carmichael joined the expedition which embarked at the Cape on the 2nd November, 1816, in order to put into effect the decision of the British Government to take possession of the Tristan da Cunha group of islands. Carmichael remained on Tristan da Cunha four months and studied the " natural production of the island." He records that the steep face of the mountain was covered with brushwood mixed with fern and long grass, which, for the most part, hid its native ruggedness. The only plant which approaches to the size of a tree is *Phylica arborea*. At that time it occupied, not only the whole plain (present settlement plateau), but also all parts of the face of the mountain where the roots could " insinuate themselves into the crevices of the rock." Under favourable conditions the *Phylica* grows up to about 20 feet in height, with a crooked twisted stem, 1–1½ feet in diameter. The only other woody plant is the shrublet *Empetrum rubrum*.

Of the herbaceous plants Carmichael points out that the most remarkable is the gigantic grass *Spartina arundinacea* : " It overruns the whole of the island from the upper edge of the tableland down to the sea-shore, accommodating itself to all soils and situations. It springs up in large close tufts, which, when full grown, are borne down by their own weight and lean upon each other in such a manner that a person may roll himself over them without any danger of sinking. Its stems grow to the length of six or seven feet, and are

of a solid, almost ligneous, texture, and are covered with a profusion of leaves. This grass makes an excellent and durable thatch, and the young leaves are eaten by horses and oxen." He continues, "the wild celery (*Apium australe*) grows in abundance over all the low ground and attains a great size, its stem sometimes measuring upwards of three inches in diameter." Of *Acaena sarmentosa* Carm., Carmichael says, "it overruns the low ground, is of no apparent utility, but an intolerable nuisance to such as have occasion to walk over the ground where it grows. Its fruit is a sort of bur, which, on the slightest touch, fixes itself on one's clothes, and falling in a hundred pieces, covers him all over with an unseemly crust of prickly seeds, not to be got rid of without infinite labour."

Carmichael was the first botanist to make an ascent to the summit of the mountain. He noted that the mountain is less precipitous after the initial stiff climb (approximately 2,500 feet), the ground very wet and "studded with tufts of rushy plants that gave way under the slightest pressure." Here also were extensive patches of the fern *Blechnum tabulare* (Lomaria robusta) "the stems of which" to use his words, "trail along the ground crossing each other in an intricate manner. This beautiful fern is more generally scattered than most of the others, being found in all moist places, from the table-land down to the plain. The trunk grows to the length of four or five feet, sometimes erect, but usually lying on the ground with its apex only upright."

At about 4,000 feet the soil practically ceases, and consequently vegetation also, except for a few mosses.

In addition to the general account of the vegetation, Carmichael gives a systematic list of the flora in which ecological notes are included. In these supplementary notes he states that the grasses *Agrostis ramulosa* and *A. media* are found on the high part of the mountain forming the chief part of the herbage.

Even in Carmichael's time the northern extremity of the present settlement plateau was denuded of its natural vegetation. By setting fire to the grass the trees were scorched and killed, otherwise it formed an "impenetrable copse."

When Moseley arrived at the settlement 57 years later, the distribution of the flora had already been considerably modified. Unfortunately, owing to unfavourable weather conditions, he had only six hours on the island. When he had reached an altitude of about 400 feet, he was recalled to the ship. "Shrubs" he says, referring to *Phylica arborea* "commence at about 400 feet elevation. There are no trees in this locality, since they have been cut down for firewood, but there is still plenty of wood on the island." *Spartina arundinacea* he found dotted about among the other herbage in rounded tufts of pale bluish green and *Nertera granadensis* (=N. depressa) very abundant creeping everywhere amongst the grass. His observations on the flora of Nightingale and Inaccessible Islands proved it to resemble very closely that of Tristan da Cunha. That of the former two islands was at that time, and still is, much less influenced by human interference.

Macklin, a medical doctor, made an ascent of the mountain behind the settlement in approximately the same direction as Moseley. He went considerably higher, however, found abundant vegetation, numbers of ferns, including the tree fern *Blechnum tabulare*, and the tussock grass, *Spartina arundinacea*, mosses, lichens and the island tree. He also found the "dogcatcher" plant *Acaena sarmentosa* referred to by Carmichael.

On another occasion Macklin made an excursion south west from the settlement, past the potato patches, to the cattle and sheep pasturage. To get round the bluff at the end it was necessary for the party to climb up to 2,000 feet. He observed that the vegetation in the gullies is very luxuriant and the grass being sheltered from the wind "grows lush and long." Over a precipice one saw below a long, grassy plain on the "back of the island where numerous semi-wild cattle graze." Going higher they found masses of tree fern and tussock grass and island tree.

Outline of Botanical Programme.

After leaving Simonstown on 23rd February, 1937, H.M.S. Carlisle, under Captain Marrick, anchored off Tristan da Cunha about 9 a.m. on Sunday 28th. In the morning the personnel and equipment were landed and a camp established on the island (Fig. 1). During the day the area near the beach landing stage, and the margin of the settlement plateau leading from it, were botanised for a distance of several hundred yards. Owing to the small size of many of the plants, progress in collecting was comparatively slow.

On the following day, 1st March, a small expedition, consisting of two marines, Arthur Rogers, an islander, and myself, set out with the object of climbing as high as possible up the mountain. We approached the cliffs up a gully about a mile south of the settlement. This must be taken into consideration when reading the floristic data which follow later. At an altitude of 1,500 feet, before the steepest part of the climb was negotiated, rain began to fall and the two marines were left in a rock shelter. With the aid of Arthur Rogers, I climbed 1,000 feet higher, often with a very precarious hold. At about 2,500 feet, with clothes drenched and limbs numb with cold, it seemed prudent not to aspire to greater heights. Collecting specimens was difficult and photography well nigh impossible: both would certainly have been unobtainable at that locality without Arthur Rogers' assistance.

The morning of the next day, 2nd March, was occupied mostly in sorting out and putting into press the saturated material collected on the mountain. In addition, with the aid of a marine, a small collection of marine algae was obtained. The most important species to the islanders is *Macrocystis pyrifera* Ag. " kelp," which grows in great quantity in deep water round the island. The long branches float near the surface checking to a certain degree the force of the waves and preventing the formation of " breakers " except under very rough conditions. It is used as a fertiliser on the potato fields.

An opportunity was made during the afternoon to plant the following grasses taken from the Rietondale Experiment Station, Pretoria :

Acroceras macrum, Stapf
Digitaria swazilandensis, Stent (Swaziland finger grass.)
Echinochloa pyramidalis, Hitchc. and Chase (Limpopo grass.)
Pennisetum purpureum, Schum. (Napier fodder.)
Echinochloa sp. (Antelope grass.)
Digitaria scalarum, Chiov. (Dunn's finger grass.)
Digitaria sp. (Pongola River finger grass.)
Panicum repens, Linn.
Panicum coloratum, Linn. (Makarikari strain.)

These were planted in short rows in Arthur Rogers' garden, with the advice that the grasses which showed promise should be planted out on a more extensive scale in order to improve the pasturage.*

* A preliminary report received from Dr. Christophersen (August, 1938), states that the results up to the time of his departure from the island were not promising. A recent letter from Arthur Rogers states that they are now mostly dead.

In addition to the grasses mentioned, the following trees and shrubs, supplied by the Director of Forestry, were taken to the island for trial. They were planted under the supervision of Mr. N. Ayson, a farmer resident at the Cape, who accompanied the expedition to give advice on agricultural matters in general.*

Timber Trees.	Common Name.	Number.
Cupressus macrocarpa, Hartw	Monterey Cypress	50
Eucalyptus cornuta, Labill	Vate	50
Eucalyptus diversicolor, F. Muell	Karri	50
Eucalyptus gomphocephala, DC	Tuart	50
Eucalyptus Lehmanni, Preiss	Lehmanni	50
Phytolacca dioica, Linn	Belhambra	10
Pinus insignis, Douge	Insignis Pine	50
Pinus halepensis, Mill	Aleppo Pine	50
Pinus canariensis, C. Sm	Canary Island Pine	50
Pinus pinaster, Soland	Cluster Pine	50
Hedge Plants.		
Hakea saligna, Knight	Hakea	40
Leptospermum laevigatum, F. Muell	Australian Myrtle	100
Myoporum insulare, R. Br.	Manatoka	100
		700

A quantity of "worms," which constitute a pest in the potato fields, attacking both the aerial growth and tubers, was received from Mr. Green. Some of these survived the journey to Pretoria but none developed further than the crysalis stage. A moth very like one of the common "cut worm" moths was collected in the grass sward near the settlement.

Special permission was granted by the Captain for me to remain that night on the island. A few sods of grass, including a root of *Spartina arundinacea* were collected on the morning of the 3rd, but no further botanising was done as we were due on board at 7.30 a.m. A few living ferns were also taken on board and are at present in cultivation at the National Herbarium, Pretoria.

Present Conditions.—Details of Botanical Work.

The landing beach is composed of pulverised, black, volcanic rock. The plants nearest high tide level are, *Mariscus congestus* C. B. Cl., *Rumex frutescens* Thouars and *Cynodon Dactylon* Pers. On the steep slope are found forms of *Scirpus Thouarsianus* Schult. *Blechnum penna-marina* Kuhn, a small hardy fern, *Chrysanthemum leucanthemum* L., *Plantago lanceolata* L., *Sporobolus capensis* Kunth and *Gnaphalium luteo-album* L. The moss *Polytrichum juniperinus* Hedw. was found in plenty near boulders on the plateau extending to about 1,500 feet altitude. Associated with it on the plateau was an abundance of *Nertera granadensis* Druce (=*N. depressa*) densely matted together with two other small runners, *Hydrocotyle capitata* Thouars and *H. asiatica* L. *Empetrum rubrum* Vahl, and *Blechnum australe* L., which were formerly common in this area, are now rare and poorly developed.

At the head of the waterfall below the settlement is *Holcus lanatus* L. Near the stream is found a variety of plants including, in addition to most of those mentioned above, *Plantago major* L. form ?, *Cotula australis* Hook., *Polygonum aviculare* L., *Cerastium caespitosum* Gillib., *Veronica serphyllifolia* L., *Rumex Acetosella* L. and *Oxalis corniculata* L.

* Dr. Christophersen states that the progress made by the trees up to the time of his departure from the island was promising and a recent report from Arthur Rogers is also encouraging.

In a small area from which sods had been removed not long previously, the following small pioneer annuals were collected: *Senecio vulgaris* L., *Juncus bufonius* L. form, *Cyperus tenellus* L.f. and *Poa annua* L.

Many of the plants listed above have been introduced to the island, mostly unintentionally, and their presence in quantity emphasises the drastic changes which have taken place in the vegetation due to the influence of man. The present settlement plateau which was, in Carmichael's time, covered by an " impenetrable copse " is now covered by a short dense grass sward. It has been grazed off short and very little of it was in flower at the time of our visit. It appeared that *Vulpia bromoides* and *Agrostis* sp. were dominant over a considerable area. Between the garden plots the grass *Poa pratensis* was found with a certain amount of *P. annua*, only the latter, however, being collected in flower. What I took to be *Trifolium repens* L. was frequent in the sward but no flowers were seen to verify the identification.

The excursion up the mountain furnished further evidence of the effects on the vegetation of heavy stocking. The short grass sward, characteristic of the settlement plateau, extended almost unbroken up the gully to an altitude of about 500 feet. At this stage scattered specimens of *Pelargonium grossularioides* Ait., *Acaena sarmentosa* Carm. and *Empetrum rubrum* Vahl occur. Much of the surface of the steep inclines is broken into long parallel steps, the initial causes of which are the combined effects of rain and tramping of animals. The soil is banked up and held in check by a dense mixed growth in which grasses and the fern *Blechnum penna-marina* are most conspicuous. On rocky portions too steep to afford a footing for animals, the vegetation is dense, but the absence of *Phylica arborea* Thouars trees is a notable feature as compared with the early records of its abundance.

At an altitude of about 1,000 feet a boulder outcrop sheltered a solitary small specimen of *Blechnum tabulare*, the island " tree fern " which formerly dominated parts of the settlement plateau. Another fern *Dryopteris aquilina* C. Chr. was also first seen here. On the neighbouring rocky cliffs, regeneration growth of *Phylica arborea* was prominent, but not a large one was to be seen.

The gully is cut off abruptly at about 1,500 feet altitude by a rock shelter. From this point the climb is mostly up a series of semi-perpendicular rock faces. The character of the vegetation changes radically. The grass sward of the lower slopes gives way to a dense growth in which ferns and mosses are dominant. Among the ferns are *Elaphoglossum succisifolium* Moore, fairly rare, *Hymenophyllum aeruginosum* Carm and *Asplenium obtusatum* Forst. var. *crassum* C. Chr. which is often found on otherwise bare rock faces with the roots penetrating the crevices in the weathered surface. *Scirpus Thouarsianus* is, for a short distance, frequently found in this association. Mosses, including the previously unrecorded genus *Sphagnum* and undescribed species are dealt with later. The endemic species *Lycopodium diaphanum* Sweet, grows commonly amongst mosses and liverworts. The abundance of these, often several matted together, is particularly interesting.

Owing to the less disturbed conditions on the mountain slopes, as compared with the settlement plateau, species such as *Hydrocotyle capitata* and *Nertera granadensis*, are more luxuriant. They also grow intertwined with mosses. At about 2,000 feet the first plant of the island celery, *Apium australe* Thouars, was recorded. *Empetrum rubrum* becomes common and more luxuriant. *Blechnum tabulare* has elongated stems and is dominant on many ridges and also in depressions (Figs. 6 and 7). While forcing a passage through a dense community of *Blechnum tabulare*, I noted on the margin of the cliff several flowers of a miniature member of the Compositae, *Lagenophora nudicaulis* Dus. (=L. Commersonii

Cass.). Its small rosettes of leaves rested on a cushion of different coloured mosses and liverworts in which the slender rhizomes were embedded. The minute fern *Hymenophyllum peltatum* Deav. occurs in the same area on the stumps of *Blechnum tabulare*.

The most arduous and dangerous part of the climb is negotiated below about 2,200 feet. Although the mountain rises steeply above this, it is not interrupted so much by perpendicular rock faces. There is an evident accumulation of soil. Grass becomes rank with scattered tufts of Cyperaceae. The only grass in flower was *Holcus lanatus* L., which is not indigenous. The Cyperaceae collected include *Carex Thouarsii* Carm., *Scirpus virens* Boeck., *S. sulcatus* Thouars, *Uncinia breviculmis* Carm. var. *rigida* Kük.

During the ascent only one small plant of *Spartina arundinacea* Carm. was recognised. Small shrubs of *Phylica arborea* appeared to be frequent on certain slopes at about 2,300 feet, but owing to the poor visibility it was practically impossible to distinguish forms even at a short distance. However, except for the eradication of the old trees of *Phylica arborea*, the indigenous flora on the upper slopes of the mountain has not been greatly changed from its natural state.

Arising out of previous statements, a note on soil erosion seems desirable.

Soil Erosion.

The subject of soil erosion on Tristan da Cunha has not been mentioned specifically in earlier literature. That soil erosion has taken place from time immemorial goes without saying. The first settlers built their homes largely of boulders which had fallen from the cliffs in the course of natural erosion. The vegetation was sufficiently dense and firmly established on the rocky slopes and plateau to retard very considerably the progress of erosion. With the advent of man and his domesticated animals and the consequent depletion of the vegetal covering, the progress of erosion was accelerated. The settlers removed the island tree (*Phylica arborea*) for firewood; the stock reduced the flora by grazing and tramping. The absorption power of the soil surface being thus reduced the "run-off" became proportionately greater.

Within the memory of middle-aged islanders, erosion along certain watercourses has assumed extensive dimensions. In Fig. 4 of the stream, which affords the settlement with a permanent water supply, the effect of erosion is clearly seen. The steep-sided watercourse is deep in comparison with the small regular flow of water. A water course to the south of the settlement is much deeper and broader yet it does not have a perennial flow of water. I have no knowledge of the area specially set apart for the grazing of the untamed or "wild" cattle.

Owing to the high rainfall, regeneration of the vegetation under normal conditions is comparatively rapid. Within the immediate vicinity of the settlement area, which is undulating or gently sloping to the seaward margin of the plateau, a short dense sward is dominant. This effectively withstands tramping and prevents the development of sheet erosion. Erosion, however, is likely to loom more seriously on the Tristan horizon than it has up to now, if precautionary measures are not adopted to control grazing on the steep slopes adjacent to the settlement plateau. There are practically no sizeable specimens of *Phylica arborea* in the neighbourhood. The regeneration growth of small shrubs should certainly be protected and not on any account be rooted up for firewood.

BOTANICAL SPECIMENS COLLECTED ON EXPEDITION.

Algae.

Very little time was available for collecting "sea weeds" but in spite of this, with the aid of a marine, the following species were obtained on the rocks below the settlement. The material was identified at the Royal Botanic Gardens, Kew, and the majority of them are new records.

Phaeophyceae.

Macrocystis pirifera (*Turn.*) Ag. No. 3617.*

Splachnidium rugosum (*L.*) *Grev.* No. 3605.

Rhodophyceae.

Callymenia Harveyana *J. Ag.* No. 3610.

Dipterosiphonia sp. possibly new. No. 3616.

Epymenia obtusa (*Grev.*) *Ktz.* ? No. 3612.

Gymnogongrus polycladus (*Ktz.*) *J. Ag.* Nos. 3606, 3613.

Iridaea ciliata *Ktz.* Nos. 3608, 3609.

Chlorophyceae.

Cladophora flagelliformis (*Suhr.*) *Ktz.* No. 3615.

Enteromorpha sp. No. 3611.

Ulva lactuca *L.* Nos. 3614, 3618.

No. 3607, indeterminable.

Fungi.

Psalliota sp. (Agaricaceae, "mushroom").

Only one immature plant was collected just prior to departure. Islanders stated that the "mushrooms" were common at certain seasons during which time they were eaten.

Lichens.

Owing to lack of time, this group was almost entirely neglected. One species collected, however, although widely distributed elsewhere, is a new generic record for the island.

Cladonia pyxidata (*L.*) *Hoffm.* Associated on an old stump of *Blechnum tabulare* with several species of moss about 2,200 feet alt., No. 3579.

Parmelia sp. On *Blechnum australe* stump, about 2,000 feet. alt. No. 3561.

Parmelia sp. possibly *P. saxatilis* (L.) Ach. On rocks about 1,000 feet alt. No. 3550.

Hepatics.

Several specimens were collected and identifications are still awaited from oversea.

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* Collector's numbers are those of the writer.

Mosses.

By H. N. Dixon.

The mosses collected by R. A. Dyer on Tristan da Cunha were received under seventeen numbers, but some of these included several species, and the total amounted to 25 species. Hitherto some 40 species have been recorded from the island.

Of these 25 species, 12 are novelties for Tristan da Cunha, a considerable proportion. Apart from the four new species, the chief interest lies in the geographical distribution of the newly recorded plants. These may be tabulated as follows :—

New Species.

Name.	*Affinity.*
Blindia brachystegia	*B. gracillima* Mitt. Kerguelen. *B. magellanica* Schimp. Fuegia, New Zealand.
Bryum flaccidifolium	*B. tenuirete* Dus. Guaitecas.
Porotrichum atlanticum	Mascarene or S. American species.
Eurhynchium crassicostatum ined*	

New Records.

Name.	*Distribution.*
Sphagnum amblyphyllum, Russ.	Wide.
Rhacomitrium lanuginosum (Hedw.), Brid.	Wide.
Dicranoweisia antarctica (C. M.), Par.	Fuegia ; Campbell Is. ; New Zealand.
Dicranum aciphyllum (H. f. & W.)	Temperate S. America ; Falklands ; S. Georgia ; Antarctic.
Dicranoloma imponens (Mont.), Par	Fuegia.
Dicranoloma Harioti (C. M.) Par.	Fuegia.
Orthostichopsis subimbricata (Hampe), Broth.	Mascarene Islands.
Leptodontium interruptum (Mitt.), Broth.	Amsterdam I. ; New Zealand.

The distribution of these newly recorded species agrees on the whole very well with what is already known of the general affinities of the bryophytic flora of Tristan da Cunha ; that is to say a small but appreciable percentage is endemic, a considerably larger proportion sub-antarctic and particularly Fuegian ; a very small number distinctly associated with the New Zealand flora, and a still smaller but very marked association with the flora of the Mascarene Islands. One of the most marked features is the almost entire absence of any association with the general African continental flora.

As all the specimens were gathered at or about the same locality, viz. about 2,200 feet altitude under conditions always moist, and at the same date, 1st March, 1937, it has not seemed worth while to repeat these data.

* I have just studied the very large collection of mosses made by the Norwegian Scientific Expedition, 1937–38, which is of remarkable interest. I find that the *Eurhynchium* of which you collected two fragments is a new species (Dixon, 1/4/39).

Sphagnum amblyphyllum, *Russ.* No. 3591. Mr. W. R. Sherrin has examined this, and writes that he does not find it differs from the widely spread plant of the North Temperate zone. The pores are rather fewer than usual, but not more so than may be found in *S. amblyphyllum*. The genus is new to Tristan da Cunha.

Ditrichum conicum, *Mont.* No. 3601b. A few stems only.
Pseudodistichium atlanticum, *Dix.*, forma elata. No. 3586g.
Blindia brachystegia, *Dix.*, sp. nov.

Caules circa 3 cm. alti, caespites sat densos, sericeos, olivaceovirides instruentes. *Folia* parum conferta, erecto-patula, sicca parum mutata, 2.5 3 mm. longa, e basi angusta, convoluta, lanceolata sensim tenui-subulata, integra, apice saepe paucidenticulata. *Costa* angusta, ad basin 30–40 μ lata, tenuis. *Cellulae* anguste lineares, infra sensim longiores, parietibus firmis; alares magnae, aetate rubrae, auriculas paullo dilatatas, magnas, decurrentes formantes.

Dioica: *Flores* turgidi, antheridiis magnis. *Perichaetia* turgida, bracteae internae e basi lata, convoluta, raptim in subulam contractae. *Seta* perbrevis, cygnea, crassiuscula. *Theca* subglobosa, pachydermica, exothecii cellulis irregularibus, valde incrassatis, apud orem seriebus pluribus transverse rectangularibus, parietibus horizontalibus fortiter incrassatis: *Operculum* altiuscule conicum, rectum. *Annulus* 0. *Spori* 20–28 μ. *Peristomii* dentes lanceolati, intense purpurei, fortiter trabeculati.

Hab. alt. 700 m., Tristan da Cunha, 1 Mar., 1937. No. 3594.

Very near to the Kerguelen *B. gracillima*, Mitt., and scarcely differing in the vegetative characters, but markedly distinct in the fruit; the lid there is conico-rostrate, with a long, curved beak, while here it is shortly conical. The spores here also are larger, in *B. gracillima* being 18–22 μ.

B. magellanica differs in the denser foliation, wider leaf base and longer lid.

Dicranoweisia antarctica (*C. M.*), *Par.* No. 3601c.

New to Tristan da Cunha.

Dicranum aciphyllum, *H. f.* & *W.* Nos. 3592e, 3596. With young and very old capsules, which is noteworthy, as it is a dioicous species.

New to Tristan da Cunha.

Dicranoloma imponens (*Mont.*), *Par.* Sparse in one or two gatherings.

New to Tristan da Cunha.

Dicranoloma Harioti (*C. M.*), *Par.* In several gatherings, and in fair quantity. No. 3586c is a form with strongly falcate leaves, the forma *falcata* of Roivainen (Syn. *Dicranum fuegianum*, Dus.). The leaves are usually much shorter in this form than in most of the typical gatherings.

New to Tristan da Cunha.

Campylopus introflexus, *Brid.* No. 3553b.

Leptodontium interruptum (Mitt.), Broth. Nos. 3589, 3592b and mixed among other gatherings. A very interesting plant, as it is only known from Amsterdam Island and from New Zealand, where it appears to be rare.

New to Tristan da Cunha.

Rhacomitrium crispulum, H. f. & W. No. 3601a. This is the *R. membranaceum* of Mitten, but it certainly cannot be separated from the widely spread, subantarctic *R. crispulum*.

Rhacomitrium lanuginosum (*Hedw.*), *Brid.* Nos. 3695c, 3597.

New to Tristan da Cunha.

Macromitrium fimbriatum (*P. Beauv.*), *Schwaegr.* No. 3584.

Bryum flaccidifolium, *Dix.*, sp. nov.

Pseudotriquetra. Humile, sordide olivaceo-viride, molle, flaccidum. *B. neodamensi* Itzigs. affine; differt foliis mollioribus, angustioribus, minus concavis, apice obtuso sed minus rotundato, vix cucullato; cellulae parietibus multo tenuioribus, limbo minus definito, costa debiliore.

Fructus ignotus.

Hab. alt. circa 700 m., Tristan da Cunha, 1 Mar., 1937. No. 3587.

Near *B. neodamense*, but more flaccid, with narrower leaves, obtuse, but not rotundate at apex, and scarcely cucullate, with thinner-walled cells and weaker nerve. It is also very near *B. tenuirete* Dus. from Guaitecas, but as figured by Cardot the leaves there are more ovate and slightly narrowed to the obtuse apex, while here they are distinctly elliptic in outline.

Eustichia longirostris (*Brid.*), *C. M.* No. 3586h.

Bartramia sp. No. 3601d. A single stem, of no doubt Section *Vaginella*, but with the sheathing leaf base tapering upwards and passing gradually into the lamina; the cells lowly tubercular almost to base.

Breutelia tenuifolia (*Mitt.*), *Par.* Nos. 3592, 3598b, and among other gatherings, in fact generally mixed with most of the specimens.

Ptychomnion densifolium (*Brid.*), *Jaeg.* Nos. 3595a, 3695d. In several other gatherings also, and showing much variation in size, but without manifesting any tendency to intergrade with other related species.

Orthostichopsis subimbricata (*Hampe*), *Broth.* No. 3586f. A very small quantity. New to Tristan da Cunha, and only known from Madagascar.

Porotrichum atlanticum, *Dix.*, sp. nov.

Frons unica, gracilis, inventa, 4 c.m. alta, parce divisa, divisionibus sat regulariter pinnatis, ramis complanatis, vix 1 cm. longis, 1 mm. latis, iterum parcissime brevissime ramulosis. *Stipes* rigidus, foliis infimis e basi arctissime adpressa brevissime cuspidatis, cuspide rigide patente acuta; supra magis magis foliaceis, membranaceis, patulis. *Folia* caulina complanata, sicca estriata, 1–5 mm. longa, valde asymmetrica, ovata, breviter acutata, acuta, uno margine plano, altero inflexo, superne argute, haud grosse, subdistanter inaequaliter denticulato. *Costa* tenuiuscula, circa $\frac{3}{4}$ folii longitudinem attingens. *Cellulae* inferiores lineares, breviusculae, supra sensim breviores et latiores, superiores omnes breviter rhomboideae, 2–3 × 1. *Folia* ramea multo minora, subcomplanata, costa debiliore, cellulis paullo brevioribus, cetero subsimilia.

Cetera ignota.

Hab. Circa 700 m. alt., Tristan da Cunha, 1 Mar., 1937, No. 3592f.

The position of this (whether in Porotrichum or Thamnium) is rather doubtful. *P. valdiviae* (C. M.) Mitt., from Chile, closely resembles it, but has narrower leaves, and all the stipes leaves foliaceous, etc. The Mascarene *Pinnatella tamariscina* (Hampe) Broth. is much like it in leaf form, but the habit is very different, and the leaves broader and rounder in outline.

Thuidium curvatum (*Mitt.*). Nos. 3595f, 3599. A rather remarkable form (3595c), is much more robust and rigid than most of the specimens, the leaves all larger and less incurved when dry as well as when moist; the stem leaves especially with long, rigid subulae, widely divaricate when dry and slightly recurved. Most of the specimens of the species that I have seen from the island are very much alike, small and slender with all the leaves (stem and branch) small and similarly incurved-catenulate when dry. If the Tristan plant is truly distinct, then this form is well worth a varietal name. But I strongly suspect that it is not specifically different from the New Zealand and South American *T. furfurosum*, which in its slender forms [*T. sparsum* (H.f. & W.) Jaeg.] very closely resembles, to say the least, the Tristan da Cunha plant. If this is the case, then the form referred to is but a slight divergence from the type compared with the many and varied forms which *T. furfurosum* exhibits.

Drepanocladus uncinatus (*Hedw.*) *Warnst.* Nos. 3598a, 3589, etc.

Eurhynchium crassicostatum *Dix.* ined. Nos. 3593, 3592d.

New to Tristan da Cunha.

Hypnum cupressiforme (*Hedw.*) *Brid.* No. 3586b. A curious form, most of the leaves being straight, and with small alar cells; in this condition it is very unlike the typical plant. A few leaves here and there, however, are falcate, and have the larger, characteristic lower alar cells, thus revealing its identity.

Polytrichum juniperinum *Hedw.* No. 3553.

Ferns.

No new records were made in this group.

Hymenophyllum aeruginosum, *Carm.* Frequent at the base of larger ferns, e.g. *Blechnum tabulare,* and amongst moss, not readily observed owing to small size, 2,000–2,400 feet alt., No. 3558.

H. peltatum, *Desv.* On old stump of *Blechnum tabulare* mixed with moss, possibly frequent but less readily observed than *H. aeruginosum*, about 2,200 feet alt., No. 3582.

Polypodiaceae (Alphabetical list).

Asplenium obtusatum, *Forst. f.* var. **crassum** *C. Chr.* Scattered on bare rock faces without soil, and occasionally growing in leaf mould with mosses, 1,500–2,000 feet alt., No. 3561.

Blechnum australe, *L.* Rare on steep rocky slope from landing beach to the settlement, No. 3522, frequent elsewhere in gullies according to islanders.

Blechnum penna-marina, *Kuhn.* Frequent on steep and precipitous slopes and rock faces, often forming dense consocies or associes with *Elaphoglossum laurifolium*; prevents excessive soil erosion in parts by the binding effect on the soil of its dense rhizomatous growth, 30–1,500 feet alt., No. 3521.

Blechnum tabulare, *Kuhn.* (the island " tree fern "). Rare between rocks at 1,000 feet alt. and nearly stemless; at 2,000 feet alt. it becomes dominant in parts on ridges and in some depressions, about 3–4 feet tall, sheltering a wealth of moss, lichen and *Hymenophyllum* spp., sterile fronds more rigid than the South African form and the pinnae with somewhat revolute margins, No. 3555. In Thouars' and Carmichael's time *Blechnum tabulare* was common on the settlement plateau with *Phylica arborea* the " island tree."

Dryopteris aquilina *C. Chr.* Occasional to frequent, stemless or with short thick stem, among rocks, some fronds 2½–3 feet long, 600–1,000 feet alt., No. 3554.

Elaphoglossum laurifolium, *Moore.* Fairly rare on steep rocky slopes with moss, etc., 6–15 ins. tall, about 2,000 ft. alt., No. 3557.

E. succisifolium, *Moore.* Frequent on rockfaces in dense associes with *Blechnum penna-marina*, 6–12 ins. tall, 1,000–1,500 ft. alt., No. 3556.

Gymnogramma cheilanthoides, *Sw.* Apparently rare, growing with moss and other small ferns, about 2,000 ft. alt., No. 3578.

Polystichum adiantiforme, *J. Sm.* Apparently rare, on steep rocky slope with moss and fern, about 2,000 ft. alt., No. 3562.

Vittaria stricta, *Carm.* (*Vittaria vittarioides C. Chr.*). Apparently rare, on steep rocky slope with moss and fern, about 2,000 ft. alt., No. 3559.

Lycopodiaceae.

Lycopodium diaphanum *Sw.* Frequent on steep slope amongst moss and other short dense growth, long lateral branches penetrating moss and rooting at the nodes, 2,000–2,300 ft. alt., No. 3563.

Flowering Plants.

Among the phanerogams the following six are recorded for the first time. Almost certainly all of them were introduced by man.

Cynodon Dactylon (L.) Pers.
Cyperus tenellus L.
Juncus bufonius L. form.
Polygonum aviculare L.
Plantago major L. form.
Veronica serpyllifolia L.

These were all growing within a radius of a few yards on the margin of the settlement plateau between the settlement and the beach landing stage. At least two were collected previously by Keytel, but owing to his poor material, they were not definitely identified. Keytel's specimens, tentatively named *Scirpus cernuus* and *Nertera assurgens* are, respectively, *Cyperus tenellus* and *Veronica serpyllifolia*. In view of Christophersen's remarks about the poor condition of some of Einar Siggeson's specimens, it is possible that he also may have collected some of the above-mentioned species in an unrecognisable state.

Of these newly recorded species the most important one economically is *Cynodon Dactylon*. It has taken a firm hold on the sand above high water level near the landing stage and is also spreading on the margin of the settlement plateau. Owing to its aggressive character it will, in due course, no doubt make a bid for dominance over the settlement plateau. It is likely to prove an asset in the work of preventing and checking soil erosion and at the same time is a useful addition to the fodder plants on the island.

Gramineae.

Agrostis simulans *Hemsl.* Apparently frequent in sward of the settlement area but not many specimens in flower, probably owing to grazing, No. 3534. In association with other species of grass not in flower, forming dense sward on small ridges of mountain slope, leading up gully, up to 1 foot high with protection, 500–1,000 feet. alt., No. 3551.

Mr. C. E. Hubbard, Kew, reports—" Nos. 3534 and 3551 probably represent the same species as *Agrostis simulans* Hemsley from St. Helena. The degree of development of the awn on the lemma appears to be very variable ; in some cases it may be represented by a minute point only, whereas in others it is comparatively long. *Agrostis Helenae* Steud. may be an earlier name for the species but the type has not been examined."

Cynodon Dactylon *Pers.* (First record.) Producing vigorous growth with strong runners, frequent on steep slope from landing beach above high water level and on margin of settlement plateau, No. 3540.

Holcus lanatus *L.* (Yorkshire Fog). Scattered on slope from the beach but not much in flower : dense clump in flower at top of the waterfall below the settlement, No. 3525. Up mountain about 1 mile south of settlement associated with several species of Cyperaceae, 9–18 inches high, 2,300–2,400 feet alt., No. 3570.

Poa annua *L.* Frequent in a small area near the margin of the settlement plateau and elsewhere, No. 3530.

Poa pratensis *L.* Not in flower, sod containing it collected in the settlement area and grown at the National Herbarium, Pretoria, where it flowered in October, 1937, No. 3625.

Spartina arundinacea *Carm.* (Tussock grass, thatch grass.) An isolated young tuft 18 inches high, about 1,000 feet alt., No. 3576. Cultivated in Fred Rogers' garden for repairing thatch, 6–7 feet high, No. 3577.

When Thouars and Carmichael arrived it overran the whole of the island from the upper edge of the settlement area down to the sea shore.

Sporobolus capensis *Kunth* [*S. indica* Auct. non (*L*) R. Br.]. Densely tufted on slope from landing beach, frequent, about 15 inches tall, No. 3541. On margin of settlement plateau, about 20 inches tall, No. 3541a. The difference in growth of the two collectings was apparently due to the better soil condition of the latter.

Vulpia bromoides *Gray.* In damp depressions below the settlement towards the beach, common in the sward but not much in flower, a grass of fine texture, culms 4–8 inches high, No. 3533.

Cyperaceae.

Carex Thouarsii *Carm.* Occasional in dense tufts on margin of " tree fern " *Blechnum tabulare* consocies with other species of Cyperaceae and the grass *Holcus lanatus*, about 18 inches high, 2,300–2,400 feet alt., No. 3572.

Cyperus tenellus *L.* (first record). Near margin of cliff below the settlement ; one of the pioneers in a small area where turf had been removed, annual about 2 inches high, No. 3523.

Although recorded here for the first time, it was collected by Bonomi (1904) and probably Keytel (1908–9) as discovered by comparison with specimens in the South African Museum, Capetown. These specimens in the S.A. Museum were placed tentatively under *Scirpus cernuus* Vahl. var. *subtilis*. In view of this it would be advisable to check the identification of earlier collectings from Tristan da Cunha named as *S. cernuus* in other herbaria.

Mariscus congestus *C. B. Cl.* (*Cyperus congestus* Vahl.). Frequent on black, sandy volcanic soil above landing beach, with grass, forming tufts with short rhizomes, 9–18 inches high, No. 3542.

Scirpus sulcatus *Thouars.* Scattered in dense growth of other species of Cyperaceae and grass, near " tree fern " *Blechnum tabulare* consocies, in tufts 9–18 inches high, 2,300–2,400 feet alt., No. 3574.

S. Thouarsianus *Schult.* Frequent in dense tufts and mats on rock faces, with little or no soil, 2–3 inches high, about 1,500 feet alt., No. 3571.

S. Thouarsianus *Schult.* var. **bicolor** *Hemsl.* On rock faces and in tufts with short runners in grass near boulders on the settlement plateau towards the beach, frequent, No. 3543.

S. virens *Boeck.* Apparently comparatively rare in dense growth of other species of Cyperaceae and grass, near "tree fern," *Blechnum tabulare* consocies; in tufts about 9 inches high, 2,300–2,400 feet alt., No. 3573.

Until the above identification was received from Kew, I did not associate this specimen very closely with **S. Thouarsianus.** My material of the latter has only a few, and those poor, spikelets, which look very distinct from the comparatively large dense ones of my No. 3573 (*S. virens*). The habit of the plants is also different and it is only on detailed examination that the points of similarity become evident. Whether it should be considered as a variety of *S. Thouarsianus* as done by Hemsley is one of the problems which was to engage Dr. Christophersen's special attention. In addition to the differences in habit the dissected specimens of my 3573 usually had two style branches united only near the base and three stamens: those of 3571 had the style branches further united and only two stamens. The glumes of the latter were narrower and more thickened down the back.

Uncinaria brevicaulis *Thouars* var. **rigida** *Kük.* Occasional in grass with other cyperaceous growth, near margin of "tree fern" *Blechnum tabulare* consocies, in tufts 18 inches —2 feet high, 2,300–2,400 feet alt., No. 3575.

Juncaceae.

Juncus bufonius *L.* forma (new record). On margin of settlement plateau towards sea, pioneer on small cleared area, apparently an annual, No. 3524.

Juncus tenuis *L.* On margin of settlement plateau towards sea, in grass near stream, occasional to frequent in small tufts, No. 3526.

Polygonaceae.

Polygonum aviculare, *L.* (introduced; new record). Near margin of cliff below the settlement, evidently only recently introduced, No. 3529.

Rumex Acetosella *L.* On margin of cliff below the settlement in short grass and on stream bank, rather dwarf, frequent but not much in flower, No. 3519. Mixed with grass, moss, etc. on mountain slope, up to 18 inches high; 2,000 feet alt., No. 3580.

Rumex frutescens *Thouars.* Near sea shore and near the settlement stream, frequent, with tough, short or straggling stem up to about 1 foot long, No. 3518.

Caryophyllaceae.

Cerastium caespitosum *Gilib.* Occasional near margin of the settlement plateau in grass, No. 3532.

Rosaceae.

Acaena sarmentosa *Carm.* (=*A. sanguisorba* Auct.). Procumbent sub-shrub in grass with *Empetrum rubrum*, fruiting stage past, 500–1,500 feet alt., No. 3549.

Leguminosae.

Trifolium repens *L.* Noted in grass, not in flower and not collected.

Oxalidaceae.

Oxalis corniculata *L.* On margin of the settlement plateau, occasional in grass, No. 3535.

Geraniaceae.

Pelargonium grossularioides (*L.*) *Ait.* (=*P. acugnaticum Thouars*). Frequent in grass with *Empetrum rubrum* and *Acaena sarmentosa*, evidently grazed somewhat by stock, procumbent, fl. pink, 500–1,000 feet alt., No. 3547.

Empetraceae.

Empetrum rubrum *Vahl* (Island berry used for pies). Small Erica-like shrub with spreading branches, rare on margin of cliff below the settlement, where it was formerly common; not in fruit, No. 3520. Frequent on steep slope in grass with *Acaena sarmentosa*, in fruit, berries sour, red to black on same plant, 500 feet alt., No. 3548. In dense grass near *Blechnum tabulare* associes, berries very plentiful, 2,300 feet alt., No. 3567.

Rhamnaceae.

Phylica arborea *Thouars* (the island tree). Shrub up to about 6 feet high (formerly up to 20 feet in this area), now only regeneration growth on rocky slope, No. 3552.

Umbelliferae.

Apium australe *Thouars* (island celery). On steep slopes in dense fern and moss growth, 1–1½ feet high (formerly abundant and more luxuriant) about 2,000 feet alt., No. 3568.

Hydrocotyle asiatica *L.* Runner in short grass near margin of the settlement plateau, occasional to frequent in patches, No. 3537.

H. capitata *Thouars.* Runner with short internodes, in dense patches with grass and *Scirpus Thouarsianus* var. on margin of the settlement plateau, No. 3538. In dense moss and *Lycopodium* growth, much more luxuriant than specimens collected near the settlement, about 2,000 feet. alt., No. 3566.

Scrophulariaceae.

Veronica serpyllifolia *L.* (new record but collected previously Keytel 1822 in S. Afr. Museum, Capetown). Small diffuse herb in grass near stream and occasional as a pioneer, on moist bare soil with *Plantago lanceolata* and *Cynodon Dactylon*, minute mauve flowers, No. 3536.

Plantaginaceae.

Plantago lanceolata *L.* Common on margin of cliff below the settlement area and on steep slope from the landing stage, varying considerably in height according to the situation, No. 3546.

P. Major *L.* ? On margin of the settlement plateau, in small area, dwarf herb 2–4 inches high, apparently perennial, No. 3531. The specimens probably represent a form of this variable species although considerably smaller than plants growing in other countries under favourable conditions.

Rubiaceae.

Nertera granadensis (*L. f.*) *Druce* (=*N. depressa* Banks and Sol.). Frequent on margin of settlement plateau towards the landing beach, small runner rooting at nodes, forming dense patches in grass and near boulders, with many red berries, No. 3539; mixed with moss on mountain side, not in fruit as near coast and not in dense mats, about 2,000 feet alt., No. 3581.

The specimen collected by Keytel, tentatively named as *N. assurgens* Thouars, is *Veronica serpyllifolia L.*

Compositae.

Chrysanthemum leucanthemum *L.* Frequent on slope leading from beach landing place and along the settlement watercourse above waterfall; leaves either nearly entire or deeply pinnate, plant from almost stemless up to 1 foot high, No. 3544.

Cotula australis *Hook.* Occasional on margin of grass sward near the settlement stream, No. 3528.

Gnaphalium luteo-album *L.* Frequent in parts on margin of cliff below the settlement plateau, 3–12 inches high, No. 3545.

Lagenophora nudicaulis *Dus.* (=*L. Commersonii* Cass.) Delicate herb producing slender runners amongst mosses and *Nertera granadensis*, flower mauve, evidently rare, only one small colony found, 2,300 feet alt., No. 3569. The discovery and collection of this minute rarity was one of the " highlights " of the climb in the drenching rain.

Senecio vulgaris *L.* Pioneer annual 3–9 inches high in small clearing on the settlement plateau, near cliff, No. 3527.

Sonchus oleraceus *L.* was observed in a garden but not collected.

COMPOSITION OF FLORA.

	Phanerogams. (Flowering Plants.)		Cryptogams.						
	Indigenous.	Introduced.	Ferns.	Mosses.	Liverworts.	Lichens.	Fungi.	Algae.	Total.
Prior to "Carlisle" expedition..........	42	32	30	38	11	12	2	19	186
Present record ..	42	38	30	50	11 ?	13	3	25 ?	±212

SUMMARY OF RESULTS.

(1) Several new records of " sea weeds " (Algae) were made.

(2) One lichen was a new generic record for the island.

(3) Among the mosses collected were four novelties and eight additional new records for the island.

(4) Six flowering plants were recorded for the first time, all of which were probably accidentally introduced to the island within recent times.

(5) Soil erosion is on the increase on the settlement plateau and the problem of combating it should be seriously considered.

(6) Selected species of grass and trees from the Union Department of Agriculture and Forestry were planted on the island as an experiment.

(7) Composition of flora (see table above).

(8) Illustrations.

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ILLUSTRATIONS.

(Photographs by the Author.)

(1) Settlement of Edinburgh on N.-W. of Tristan da Cunha.

(2) Approach to the settlement from landing beach : this area was covered by an " impenetrable copse " in 1816, according to Carmichael : island cattle and young bull landed by H.M.S. Carlisle : erosion in background.

(3) Landing beach, with severely eroded slopes in the background.

(4) Settlement stream with steeply eroded banks : in background New Zealand flax (Phormium tenax Forst.) cultivated in a garden for thatching.

(5) Cottage roof thatched with *Spartina arundinacea*, pieces of turf along the top to prevent leakage during storms : (New Zealand flax is cultivated and also used for thatching, see Fig. 4).

(6) *Blechnum tabulare* on precipitous slopes at about 2,400 feet alt. (heavy rain at the time).

(7) *Blechnum tabulare*, as in Fig. 6, near view, with Arthur Rogers.

Fig. 1.—Settlement of Edinburgh on N.-W. of Tristan da Cunha.

Fig 2.—Approach to settlement from landing beach: this area was covered by an "impenetrable copse" in 1816, according to Carmichael: island cattle and young bull landed by H.M.S. Carlisle: erosion in background.

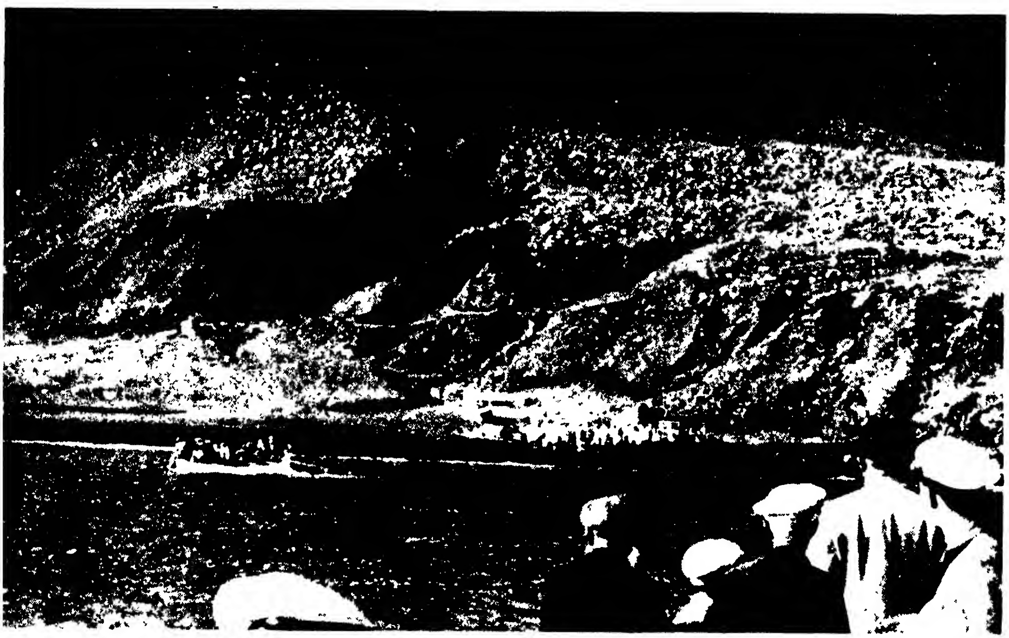

Fig. 3.—Landing beach, with severely eroded slopes in the background.

Fig. 4.—Settlement stream with steeply eroded banks: in background New Zealand flax (Phormium tenax Forst.) cultivated in a garden for thatching.

Fig. 5.—Cottage roof thatched with *Spartina arundinacea*, pieces of turf along the top to prevent leakage during storms: (New Zealand flax is cultivated and also used for thatching, see Fig. 4).

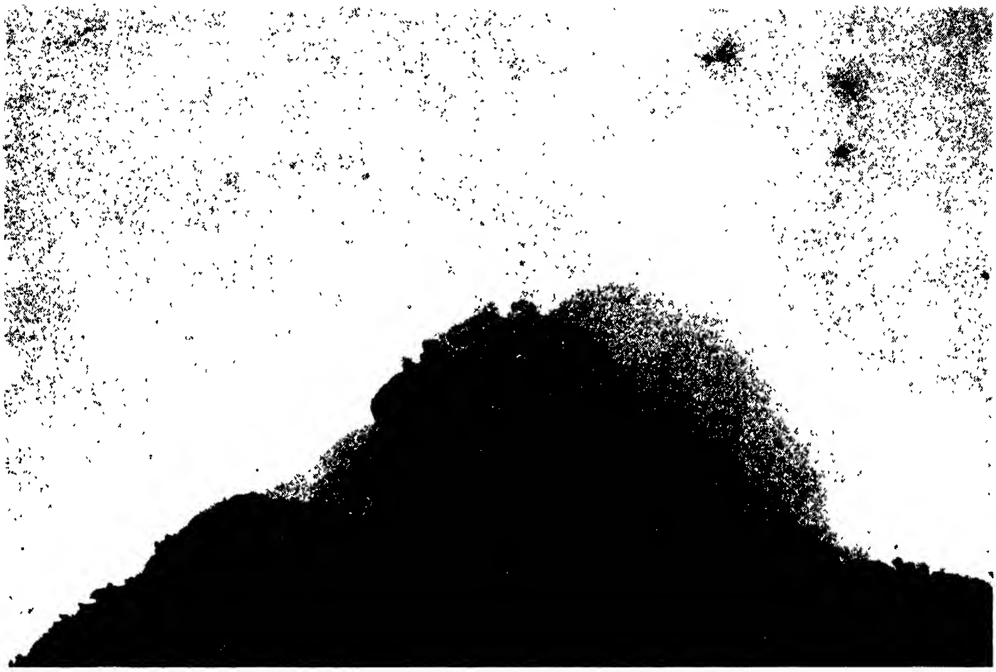

Fig. 6.—*Blechnum tabulare* on precipitous slopes at about 2,400 ft. alt. (heavy rain at the time).

Fig. 7.—*Blechnum tabulare,* as in Fig. 6, near view, with Arthur Rogers.

A REVIEW OF THE GENUS *ADROMISCHUS* LEMAIRE.*

By C. A. Smith.

[Indexed at end of the Article.]

The genus *Adromischus* was first described by Lemaire (Jard. Fleur. II. Misc. 59) in 1852, two species—*A. robustus* and *A. mucronatus*—being described by him for the first time, and nine species, originally described by their authors under *Cotyledon* Linn., were transferred [according to Berger (1)] by Lemaire to his new genus. These species all had in common a dwarf habit and a spicate or racemose arrangement of the usually erect flowers round the upper part of the elongated and scape-like inflorescence-rhachis in 1—2—3-flowered cymules, characters which these species do not share with typical species of *Cotyledon* Linn. (emend.) and which were utilised by Harvey (2) about 10 years later, when he monographed the known South African species of the genus for the first time, for his Sect. *Spicatae.* Under this section Harvey (2) described *Cotyledon Zeyheri* Harv., and redescribed *C. hemisphaerica* Linn., *C. cristata* Haw. and *C. mammillaris* Linn. f., the incorrectness of his treatment of these species being noted further on under their respective heads. Five species, which really also belong to this section, were further enumerated by Harvey (2) under the "Imperfectly known and doubtful species," and he seems to have been quite ignorant of Lemaire's paper, for he does not refer to the two species described by Lemaire under *Adromischus*, nor to this generic name. Harvey certainly appears to have regarded the characteristic inflorescence features as having no more than sectional value.

The same state of affairs seems to have obtained among all later authorities, for example Dr. S. Schonland in his several papers on the South African species of *Cotyledon.* No reference to Lemaire's article is found until the late Professor Alwin Berger monographed the *Crassulaceae* (1), vol. 18. Here Berger resuscitated Lemaire's generic name and gave the transferences of eight additional species, seven of which had been described under the generic name *Cotyledon* in recent times, so that the genus *Adromischus* Lem., as circumscribed by Berger (1), then stood accredited with 15 species, Lemaire's two species being held by Berger to be conspecific with two previously described plants. In the present paper, the writer has added a further 15 to Berger's total, either as hitherto undescribed species, or as new transferences, or new names, together with critical notes on some of the older species, as well as including three from other German authors and not previously referred to.†

* This paper was completed in the year 1938, and references to some of the later authors, e.g. von Poellnitz, have been inserted by the Editor. (See also Appendix.)

† The latest area to yield an interesting series of species new to botanical science, is South-West Africa, where Dr. Kurt Dinter has been responsible for the discovery of these novelties. Thus the present article has included four from that Territory, but it would appear from current publications that correct identification of the species (judging from the descriptions published) is as rare as imaginative nomenclature for the species.

As re-circumscribed for purposes of this paper, the genus presents the following outstanding characteristics :

1. The stems are succulent in all species, though variously developed, being frequently very dwarf [*A. nanus* (N. E. Br.), *A. cristatus* (Haw.), *A. rupicolus* *], usually about 10 cm. high, seldom up to 90 cm. (*A. kleinioides*) and rarely obsolescent [*A. humilis* (Marl.), *A. Schaeferianus* (Dtr.)] though one is described as a semi-shrub (*A. montium-Klinghardtii*).

As a rule they are unbranched, though a number have a few very short and stubby or podgy branches [*A. hemisphaericus* (Linn.), *A. umbraticolus*, *A. rotundifolius* (Haw.)], while at least one [*A. caryophyllaceus* (Burm. f.)], is very distinctly branched, and are erect and suffrutescent, being very rarely prostrate and rooting at the nodes [*A. mammillaris* (Linn. f.)].

In almost all species the stems are devoid of a hairy indumentum, but *A. cristatus* (Haw.) and *A. clavifolius* (Haw.) are unique in the possession of numerous short and closely interwoven reddish- to rusty-brown rather coarse and curly "aerial roots" which have water absorptive properties, according to Marloth. Such species as *A. hemisphaericus* (Linn.), *A. festivus*, etc., are frequently found with tufts of adventitious roots arising from the cauline nodes, but these should not be confused, at least as to function, with the aerial roots of the two former species. A true hairy indumentum occurs only in such species as *A. Schaeferianus* (Dinter), *A. leucothrix*, *A. Zeyheri* (Harv.), in which the leaves and inflorescence are pubescent or hispid, while in *A. cristatus* (Haw.) and *A. clavifolius* (Haw.) only the leaves are softly pubescent. In nearly all species of the genus, also, the younger parts at least are densely covered with a whitish bloom caused by a waxy secretion, this no doubt playing an important part in reducing transpiration losses.

The leaves, which are invariably thick and fleshy, are either alternate and closely crowded (or scattered), or opposite—see examples in sectional groups below—or rosulate [*A. humilis* (*Marl.*)], and, in several of the species, are beautifully spotted or blotched with purple to chocolate-brown flecks and dots—*A. festivus*, *A. Cooperi* (Baker), *A. Marianae* (Marl.), *A. tricolor*, *A. fusiformis* (Rolfe), *A. maculatus* (Salm Dyck), the spots or blotches usually flowing into an irregular and larger blotch under the apical margin. (Here may incidentally be noted that this blotching of the leaves is by no means so variable as some authorities have assumed.) In shape the leaves vary from flat and obovate-cuneate, e.g. *A. rhombifolius* (Haw.), *A. rotundifolius* (Haw.), *A. sphenophyllus*, to orbicular or suborbicular or reniform, e.g. *A. rupicolus*, *A. nanus* (N. E. Br.), to fusiform or spindle-shaped, e.g. *A. kleinioides*, *A. fusiformis* (Rolfe), *A. tricolor*, ovoid- to subglobose and terete in cross-section, e.g. *A. mamillaris* (Linn. f.), semiglobose [*A. hemisphaericus* (Linn.)], oblong or oblong-elliptic and semiterete in cross-section [*A. Marianae* (Marl.)], sometimes with a deep sulcus on the upper face (*A. leucothrix*). In all these the leaves are always distinctly sessile, but, on the other hand, *A. festivus*, *A. pachylophus*, *A. Zeyheri* (Harv.), *A. cristatus* (Haw.) and *A. clavifolius* (Haw.), share the unique property of having their much thickened terete to semiterete leaves narrowed from about the middle or lower third of their length into a distinct much thinner terete "petiolar" portion, the apices being flattened and crisped or undulate. In *A. Cooperi* (Baker), and *A. pachylophus* again, the apical part of the subcylindric leaves is flattened and expanded into an ovate or ovate-rotundate broader part, which is also a unique character in the genus, and to which the specific epithet of the latter refers.

The inflorescence invariably partakes of the nature of a typical spike or true raceme, though a hard and fast line cannot be drawn between groups of species on this score alone, since the flowers may be sessile even when mature, but become distinctly pedicelled in the fruiting stages. In their arrangement the flowers appear more usually to be singly disposed

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*** Specific names cited without an author's name are new, and are accompanied by descriptions or validating references further on.**

along the rhachis, which is most generally unbranched, but 3-flowered sessile or subsessile cymules occur in the lower half of the inflorescences of such species as *A. kleinioides*, *A. triflorus* (Linn. f.)—the specific epithet here being self-explanatory—*A. Alstoni* (Schonl. and Bak. f.), and *A. sphenophyllus*, typically so in the first two, and from 1–3 in the last two, whereas in *A. maculatus* (Salm Dyck) the number varies from 1-2 (so far as seen), though here the 1-flowered condition would appear to be the more usual.

Two well marked conditions of flower colour occur in the genus, the Little Namaqualand and Little Karoo species having striated green corolla-tubes with salver-shaped limbs which are either bright scarlet above and below or white above and scarlet to wine red on the lower face, while the more northerly species (i.e. those found north and, in the N.E., just south of the Orange River), have purple corolla-tubes and dull purple limbs which become completely reflexed over the apical part of the former, the throat being very generally of a richer and deeper purple.

The leaves of several (if not all) species are capable of rooting from the base [*A. umbraticolus*, C. A. Sm., *A. rupicolus*, *A. Marianae* (Marl.)], and in course of time will give rise to a new plant thus affording a ready method of propagation.

It would seem that at least some of the species of the genus are toxic to stock, an undetermined species from Namaqualand [probably *A. Alstoni* (Schonl. & Bak. f.)], being reported from that area as causing the so-called "krimpsiekte" in goats, while experimental feeding tests carried out with *A. umbraticolus* C. A. Sm. at Onderstepoort Veterinary Research Laboratories (near Pretoria), have shown this species to be fairly toxic with the development of cotyledonotoxin poisoning symptoms (*Cotyledonosis*), closely resembling those seen in animals poisoned by species of "true" *Cotyledon*.

Many of the species have already been accurately figured in colour (sub. gen. *Cotyledon*), though several of the plants represented by these rather excellent plates have been erroneously identified, as a glance through the synonymy given under each species below (e.g. *A. sphenophyllus*, *A. kleinioides*) will show, and it is not surprising to note that several of the older "Flora Capensis" species, in the light of critical examination, are at present known only from the type gathering [*A. Zeyheri* (Harv.), *A. filicaulis* (E. & Z.), *A. trigynus* (Burch.), *A. triflorus* (Linn. f.)]; some only from description [*A. rhombifolius* (Haw.)], the type being apparently non existent; some only from a figure [*A. hemispahericus* (Linn.), *A. Cooperi* (Baker), *A. kleinioides*, *A. fusiformis* (Rolfe)], of which the original specimens were apparently never kept, while yet other species have only been re-discovered once or thrice [*A. maculatus* (Salm Dyck), *A. caryophyllaceus* (Burm. f.), *A. mammillaris* (Linn. f.), *A. hemisphaericus* (Linn.), the first in 1908, 1926 and 1930, the second in 1878, the third in 1926 and 1930, and the last in *c.* 1821].

Many of the older species were prime favourites in European hot houses and all these were described in the first instance from cultivated plants, the earliest known species (as to actual date of publication) being *A. hemisphaericus* (Linn.), which was in cultivation in Sherard's famous garden at Eltham, near London, prior to 1737, when it was accurately figured and described by Dillenius, Linnaeus subsequently (1762) naming the species from this plate, while *A. caryophyllaceus* (Burm. f.) was figured by the elder Burmann in 1738, and named from this plate by the younger Burmann in 1768. There is however, a great deal of indirect evidence for believing that the elder Burmann figured the plant before Dillenius figured his, Burmann's figure being practically no more than a copy of a plate executed in colour at the Cape during the time of the elder v. d. Stel's governorship, i.e. prior to 1699, and contained in the famous Codex Witsenius, which was never published, but came to Burmann's hands via the Commelins. Thus he quotes that the plant "A *Casp. Commel. in Catal. MSto* ad *Cod. Wits.* vocatur Sedum Africanum montanum, foliis orbiculatis, floribus parvis, variegatis; & in *Cod. Wits.* Sedum Africanum montanum, minus, folio rotundo, flore ex rubro & albovariegato, ubi & dicitur quod in montibus

crescat inter rupium fissuras, florens Novembri." He also gives synonyms from Boerhaave and Tournefort, as well as "Cotyledon Africanum, foliis oblongis, floribus umbellatis, fibrosa radice, *Oldenl.* (sphalm. *Olendenl.*) *Catal. Plant.* Afric. p. 27," while Plunkenet's (Mant. p. 169) "Sedum Africanum, angustis longioribus foliis, Jasmini floribus umbellatum," also cited, obviously foreshadows a later epithet of the specific name *Cotyledon jasminiflora* by which the species was described by Salm Dyck (see p. 628).

It is not, of course, possible always to judge of the correctness of synonymy involving the pre-Linnaean phrase names, but there is ample reason to believe that the Dutch authors cited above, at least, were all dealing with the same species, living material of which had been collected at the Cape, most probably by Oldenland during one of his excursions to the eastern part of the Colony after plants, and sent by Governor Simon v. d. Stel to the Dutch gardens at Amsterdam and Leiden. From these historical gardens plants were also sent to many other gardens by way of exchange, both Plukenet and Tournefort, for example, receiving South African plants on a number of occasions of which there are actual records. It thus seems reasonably safe to assume that, in the particular case under review, all the authors cited had the same plant in mind. This being the case, then it follows that historically, *A. caryophyllaceus* (Burm. f.) is by far the oldest recorded species of the genus.

The Haworthian species of the genus (described by Haworth as species of *Cotyledon*, of course), were all described from specimens sent by James Bowie from the Cape to and cultivated at Kew between the years 1815–25, while Salm Dyck, who will be remembered for his monumental volumes on the "Aloes" and "Mesems," also had specimens from the Cape about the same time, principally from Ecklon, in addition to receiving some material from his correspondent Haworth, and cultivated these in his famous succulent garden on the Continent. Then there was a lapse in the introduction of new species of the genus until Thomas Cooper visited South Africa to collect plant material for William Saunders of Reigate in the early 60's. Three species of the genus were later figured for Saunders' "Refugium Botanicum"—*A. Cooperi* (Baker), *A. sphenophyllus*, *A. maculatus* (Salm Dyck)—from specimens sent to Reigate by Cooper, but it is only of comparatively recent date that such species as *A. cristatus* (Haw.) and *A. clavifolius* (Haw.), etc., are again coming into favour in Europe, a fine collection of species of the genus being in cultivation in the Royal Botanic Gardens, Kew (1930).

In general, unless exceptionally well dried, or accompanied by detailed notes on all parts of the fresh plant, accurate identification of the species from herbarium or other dried material is extremely difficult and in some cases well-nigh impossible. To obviate this difficulty in the future preservation of dried specimens should be duplicated by spirit material, as well as by accurate, wholly or partly coloured figures of the complete plant, together with notes made from the fresh plant of those features which are liable to disappear in the preservative fluid. The writer has found a system of "nature prints" made from the fresh leaves very useful in reconstructing their shape from the dried material. For this purpose cross-sections are cut at short intervals from one or more leaves with an old razor blade or sharp penknife, the exposed surface being inked over at every successive cut and carefully pressed on to a slip of paper in the exact order of the sections, this being supplemented by a "print" from a median longitudinal section of one or more leaves, care being naturally exercised not to exert undue pressure on the section in making each "print." The outlines are then very carefully inked over in india ink.

It is quite obvious, of course, that the system of "nature prints" could be used very effectively in succulent genera such as *Aloe, Haworthia, Crassula, Cotyledon, Euphorbia, Trichocaulon*, etc., and that where polymorphism in the leaves occurs, a representative series of "prints" could be made and attached to the sheet on which the dried specimen is afterwards mounted.

In maintaining *Adromischus* Lem. (emend.) as a genus distinct from *Cotyledon* Linn. (emend.), chief reliance is placed upon the characters presented by the inflorescence, in which the spicate to racemose arrangement of the 1-3-flowered cymules (as opposed to the panicled inflorescence of typical species of *Cotyledon*), is correlated with the shape of the corolla-tube, which is either somewhat ventricose above the base or narrowly cylindric, and the fusion of the segments so as to form a salver-shaped spreading or at length reflexing 5-toothed limb (rarely 5-lobed). Schonland ([3]), in his last paper on the genus *Cotyledon*, maintains Harvey's two original sections—PANICULATAE (=*Cotyledon* Linn., emend.) and SPICATAE (=*Adromischus* Lem., emend.)—but comes to the erroneous conclusion that the branching of the inflorescence of *Cotyledon caryophyllacea* Burm. f. (*loc. cit.* 151) bridges over the gap between the two sections. The arrangement of the flowers along the inflorescence-rhachis and its few racemose branches is, however, that of a typical raceme, and the structure of the corolla-tube and limb is that of other species of *Adromischus* Lem. (emend.), i.e. *Cotyledon* § *Spicatae* Harv. Branching of the inflorescence-rhachis also occurs, for example, in such species as *A. trigynus* (Burch.), *A. umbraticolus* C. A. Sm., *A. sphenophyllus*, *A. caryophyllaceus* (Burm. f.), etc., but in each case the flowers, apart from their structure, are always spicately or racemosely arranged and not panicled at the apex of the branches.

The known species of *Adromischus* Lem. appear to be readily capable of being grouped in two subdivisions, for which purpose (*a*), the inflorescence parts, and (*b*), the disposition of the leaves may be utilised :

(*a*) Owing to the inconstancy of the character presented by the type of inflorescence and the disposition of the flowers along the rhachis (1-2-3 at a node, though in some the 3-flowered condition remains constant), neither of the two characters could be employed satisfactorily for subdividing the genus. The nature of the limb of the corolla, however, is far more useful. Comparison, for example, of the corollas of such species as *A. kleinioides*, *A. rotundifolius* (Haw.), *A. maculatus* (Salm Dyck), *A. caryophyllaceus* (Burm. f.), and *A. mammillaris* (Linn. f.), with those of *A. rupicolus*, *A. nanus* (N. E. Br.), *A. umbraticolus* C. A. Sm., *A. procurvus* (N. E. Br.), show in the former group relatively long apical processes or teeth on the corolla-lobes, but these are absent or at most very much reduced in the latter group. This difference is also correlated with colour differences. Thus in the first group the corolla-tube is green and slightly ventricose above the base, and the limb white with (or without) rosy to pale scarlet flushes along the middle of each lobe, and usually scarlet to rosy-red below, or the limb entirely reddish to wine red or rusty red-brown. In the second group the corolla-tube is purple or purplish-mauve and cylindric, with a deep purple or purply-mauve throat, the limb being similarly coloured on both faces, though paler along the margins.

(*b*) A more obvious and conveniently described character for subdivision of the genus into two well marked groups is found in the disposition of the leaves on the stem, a consideration of which leads to the following :

I. Alternifolii *, Sect. nov.—Leaves alternate, usual closely crowded, though occasionally loosely scattered along the stem or its branches, rarely subrosulate.

e.g. *A. fusiformis* (Rolfe), *A. hemisphaericus* (Linn.), *A. mammillaris* (Linn. f), *A. rotundifolius* (Haw.), *A. kleinioides*, *A. caryophyllaceus* (Burm. f.), etc.

II. Oppositifolii, Sect. nov.—Leaves opposite and decussate.

e.g. *A. maculatus* (Salm Dyck), *A. Cooperi* (Baker), *A. festivus*, *A. Bolusii* (Schonl.), *A. Marianae* (Marl.), etc.

For further subdivision each of the two sections may be divided on the shape presented by the leaves in cross-section, a character already employed by Berger ([1]), who did not, however, employ sectional or subsectional names. Thus he separated those species with

*** In some of the species belonging to this section, the leaves are apparently sub-opposite, but then the one leaf is always much shorter than the one sub-opposite to it.**

flattened leaves as one group, and all the other species known to him fell into another group which he further subdivided according as to whether the leaves had a semiterete or terete cross-section. Utilising the characters here noted under each of the two sections above proposed, it follows that two subsections of each section are distinguished from one another on the same character, as will be seen from the following:

Sect. ALTERNIFOLII:

A. Platyphylli, Subsect. nov.—Leaves flattened (i.e. breadth in anterior half much exceeding the thickness, as seen in cross-section).

e.g. *A. rupicolus*, *A. rotundifolius* (Haw.), *A. humilis* (Marl.), *A. nanus* (N. E. Br.), *A. umbraticolus* C. A. Sm.

B. Heterophylli, Subsect nov.—Leaves terete or more or less semicircular (i.e. breadth more or less equal to the thickness, as seen in cross-section).

e.g. *A. cristatus* (Haw.), *A. clavifolius* (Haw.), *A. mammillaris* (Linn. f.), *A. pachylophus*, *A. fusiformis* (Rolfe), *A. leucothrix*, *A. kleinioides*, *A. hemisphaericus* (Linn.), etc.

Sect. OPPOSITIFOLII:

A. Planifolii, Subsect. nov.—Leaves flat (i.e. breadth in anterior half much exceeding the thickness, as seen in cross-section).

e.g. *A. Bolusii* (Schonl.), *A. Alstoni* (Schonl. & Bak. f.), *A. sphenophyllus*, *A. maculatus* (Salm Dyck), *A. triflorus* (Linn. f.) etc.

B. Crassifolii, Subsect. nov.—Leaves terete or semiterete (i.e. breadth more or less equal to the thickness, as seen in cross-section).

e.g. *A. festivus*, *A. Marianae* (Marl.), *A. Cooperi* (Baker), etc.

Using the above as a basis, the species falling under each subdivision may very readily be distinguished from one another by utilising such characters as are afforded by indumentum, blotching of the leaves, flower colour, etc. This article is not offered as a revision of the whole genus, so that several species mentioned in the above general survey are not mentioned further on again, the following notes referring only to such species as (in the author's opinion) were wrongly interpreted, and such as may be regarded as hitherto undescribed, the tentative key being supplied for further discrimination between the species dealt with, and to indicate the rôle leaves and flowers play in the distinctions drawn.

In order to facilitate references to specimens dealt with, the herbarium in or from which a particular specimen has been examined is indicated by the following abbreviations, but those not seen, but cited, have the herbarium names only slightly abbreviated:

Pa, National Herbarium, Division of Plant Industry, Pretoria.

K, Herbarium of the Royal Botanic Gardens, Kew.

These abbreviations are inserted in brackets after each citation. This has the advantage of indicating to others where types are preserved, and tends to eliminate confusion in the interpretations of specific names assigned to the specimens examined.

KEY TO THE SPECIES.

Leaves opposite and decussate :
- Leaves markedly flattened on both sides :
  - Corolla-tube green ; limb white or pale rosy :
    - Leaves blotched or spotted :
      - Leaves minutely dotted in the upper half. — 4. *A. rhombifolius.*
      - Leaves with large blotches all over. — 1. *A. maculatus.*
    - Leaves neither spotted nor blotched :
      - Leaves thickest in middle and upper half. — 3. *A. sphenophyllus.*
      - Leaves thickest in the lower half :
        - Flowers in 1-flowered cymules only. — * *A. Bolusii.*
        - Flowers typically in 3-flowered cymules :
          - Corolla-lobes ovate, obtuse, white above. — 2. *A. triflorus.*
          - Corolla-lobes deltoid acuminate, rosy above. — 20. *A. alston.*
  - Corolla-tube never green, but usually dull purple-mauve ; limb pale purple-mauve or mauve. — 26. *A. rupicolus.*
- Leaves not flattened on both sides :
  - Leaves terete or subterete :
    - Apex of leaf expanded into a deltoid-ovate part broader than the leaf itself ; limb of corolla wine-red and papillose in the throat. — 13. *A. Cooperi.*
    - Apex of leaf not as above ; limb of corolla white or rosy :
      - Leaves constricted at the base into a short petiolar portion, and flattened at the apex, ashy-grey between the large blotches. — 15. *A. festivus.*
      - Leaves fusiform, the apex not flattened, green between the blotches. — 12. *A. tricolor.*
  - Leaves oblong, flattened and subconcave above, convex below, thus semiterete in cross-section. — 21. *A. Marianae.*

Leaves alternate and scattered or crowded :
- Leaves markedly flattened on both sides :
  - Leaves closely spotted, especially in the upper half, and with firm white cartilagineous margins. — 23. *A. nanus.*
  - Leaves not as above :
    - Corolla-tube green ; limb white to rosy or deep maroon above, scarlet or maroon below ;
      - Plants acaulescent, tuberous-rooted, with rosulate leaves.. — 22. *A. humilis*
      - Plants distinctly caulescent, fibrous-rooted, with the leaves crowded below the apices. — 6. *A. rotundifolius.*
    - Corolla-tube never green, usually purplish-brown to -mauve ; limb mauve to purple on both sides :
      - Corolla-tube somewhat curved. — 24. *A. procurvus.*
      - Corolla-tube straight :
        - Leaves subrosulate ; stems obsolescent. — 28. *A. saxicolus.*
        - Leaves linear-oblong to elliptic-oblong sometimes crowded, but scattered ; stems welldeveloped :
          - Leaves " ovato-cuneate or suborbicular " — 25. *A. trigynus.*
          - Leaves oblong to oblong-cuneate or obovate-cuneate. — 27. *A. umbraticolus.*

Leaves not as above :
- Leaves flattened or subconcave or subconvex above, but always markedly rounded below :
  - Leaves with a distinct indumentum :
    - Leaves elongate and deeply sulcate on the upper face, closely covered with rigid white bristly hairs. — 19. *A. leucothrix.*
    - Leaves not as in the former, " almost spherical," pubescent. — *A. Schaeferianus.*
  - Leaves glabrous, at most with a waxy bloom :
    - Leaves semiglobose, papillose, with acute margins, at most 1·5 cm. long. — 5. *A. hemisphaericus.*
    - Leaves obovate or spathulate to oblong-elliptic, epapillose and glossy green, with rounded margins, up to 3 cm. long. — 7. *A. caryophyllaceus.*

* The specific names not numbered are not referred to in the text.

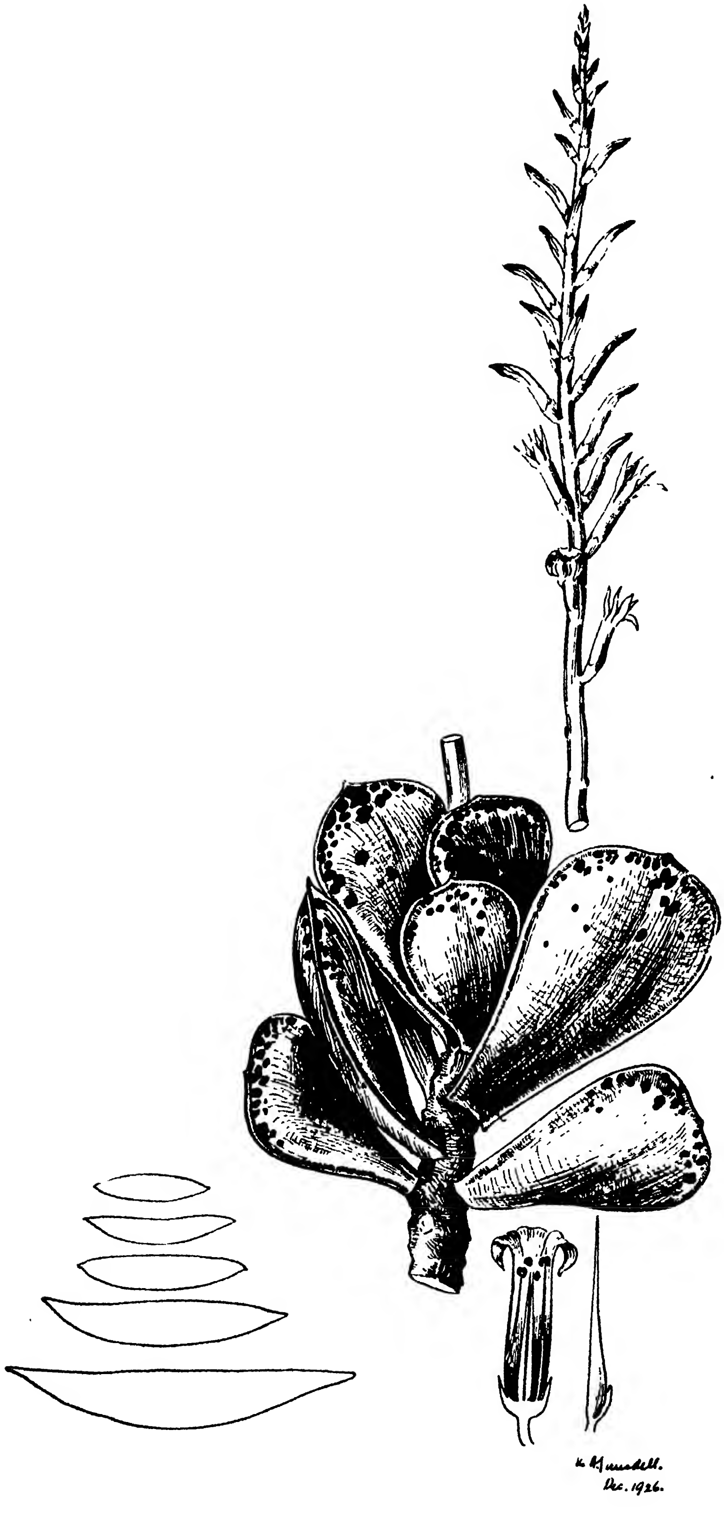
Leaves more or less terete :
Leaves abruptly narrowed into a much thinner " petiolar " part in the lower third :
Stems densely covered with rusty- to red-brown aerial roots :
Leaves flabelliform with a flattened crisped apex, and nearly as broad as long in the thick part. 17. *A. cristatus.*
Leaves elongate and subcylindric, slightly crisped at the narrow flattened apex, the thicker part very much longer than broad. 18. *A. clavifolius.*
Stems at most with nodal tufts of adventitious roots :
Leaves glabrous, expanding into a broad ovate apical part much wider than the leaves. 14. *A. pachylophus.*
Leaves pubescent, at most with a flattened but not expanded apex. 16. *A. Zeyheri.*

Leaves without a definite " petiolar " part, at most only insensibly tapering at the base :
Leaves 1–2, " almost spherical ". *A. sphaerophyllus.*
Leaves numerous :
Stems prostrate and rooting at the nodes, the vegetative parts very like those of *Kleinia radicans.* 11. *A. mammillaris.*
Stems (where developed) erect :
Stems simple or many, tall and over 10 cm. high :
" Semi-shrub, with many stems : flowers greenish-red." *A. montium-klinghardtii.*
Plants not as above ; stems simple and elongated :
Corolla limb pallid ; leaves flecked with purple. *A. fusiformis.*
Corolla limb deep maroon to red-brown on both sides ; leaves unspotted. 10. *A. kleinioides.*
Stems very dwarf (or almost to absent) :
Leaves oblong, narrowed to the base. 9. *A. Marlothii.*
Leaves fusiform ("tereti-acuminata "), tapering at both ends. 8. *A. filicaulis.*
Leaves " pea-shaped," with red dots. *A. Keihackii.*

1. A. maculatus (*Salm Dyck*) *Lem. ex Berger.*

Of this species there is a very fine coloured figure of a complete plant in the collection of drawings at Kew, dated " February 15, 1824," when it was made from " a typical plant received from Salm Dyck. Compared with an authentic specimen in Haworth's Herbarium at Oxford. Oct. 31, 1901. N. E. Br." In the above collection there is also a very careful drawing of Haworth's specimen, showing a complete inflorescence and two leaves, and against the former Haworth noted " Kew Sept. 28, 1824," while against the two leaves he noted " Hot ironed. Ex. horto, Apr. 1827." The inflorescence of Haworth's specimen thus in all probability came from the specimen " received from Salm Dyck," and from the extremely close match of the illustrations, there can be little doubt that they all represent the same species, viz. *Cotyledon* * *maculata* Salm Dyck [Obs. Bot. in Cat. Hort. Dyck. 5 (1820), ex Haw., Rev. Pl. Succ. 21 (1821)]. Now the figure of *C. maculata* in Saund., Ref. Bot. I. t. 35 (1869), agrees exactly with the figures already cited, except that the flowers are always in pairs (one of which is generally a bud) in the lower part of the inflorescence, but are singly disposed at the nodes in the apical part, whereas Haworth's specimen and the figures just cited all show the sessile flowers to be singly disposed along the rhachis, i.e. in the form of a simple spike. Specimens, again, collected by the writer at Robertson in April, 1926, flowering at the Division of Plant Industry in December of the same year, and undoubtedly referable to this species from their close match with the Kew plate, also showed single flowers at the nodes of the inflorescence rhachis, as will be seen in the accompanying Figure 1.

* For convenience, the species in these notes are cited in the text hereafter by their old name under *Cotyledon* (*C.*).


Dec. 1926.

Thus it would appear that the plant may show a variation of from 1–2 (apparently never more) flowers at the nodes, with the 1-flowered nodal condition as the more typical. Such variation in what must be regarded as an originally 3-florous cymule is by no means uncommon in the genus, occurring, for example, in *A. sphenophyllus*, the next species but one. However, in selecting the type of the name *C. maculata* Salm Dyck, the choice lies between the coloured plate made at Kew and Haworth's specimens, since Salm Dyck does not appear to have kept a specimen of the plant originally described by him. Haworth's specimens are made up of parts introduced, as noted above, at different dates, and the leaves "ex horto" were (in view of the different labelling) certainly not obtained from the same plant as the inflorescence. The coloured plate in the Kew collection should therefore be selected as representing the typical plant, the more so since it was made from specimens named and sent as *C. maculata* by Salm Dyck himself.

With reference to the "Refugium Botanicum" plate (t. 35), identified with this species above, Schonland and Baker fil. (4): state that it "may represent a spotted variety of *C. rhombifolia* Haw.", as typified (on their authority) by t. 36 of the same work. The latter, however, cannot be regarded as that species (see No. 3). Then, again, in his last paper on the genus *Cotyledon* Linn. (sensu Fl. Cap.), Schonland (3), regards "*C. maculata* Salm Dyck" as a doubtful synonym of "*C. rhombifolia* Haw.", stating: "It is . . . a little doubtful whether the plant he [Baker] figured [Ref. Bot. t. 35] as *C. maculata* Salm Dyck is really that species," but does not advance any reasons for this statement, though he further suggests (3) that "the true *C. maculata* Salm Dyck may be identical [*sic!*] with *C. trigyna* Burch." In both statements Schonland erred through erroneously identifying specimens of *C. nana* N. E. Br. as *C. maculata* Salm Dyck, from which it differs conspicuously in the structure of its flowers, though agreeing with *C. trigyna* Burch. in habit and floral characters.

For convenience Salm Dyck's original diagnosis may be here inserted:

"C. suffrutescens, foliis ovato-spathulatis basi subauriculatis, carnosis, nitidis, utrinque maculis atro-rubentibus notatis. Floribus spicatis, subalternis." Schonland and Baker fil. (*loc. supra cit.*) giving the following notes made from Haworth's specimens: "Leaves few, obovate or obcordate emarginate, apex obtuse with a short acumen, margin cartiligineous sometimes undulate, base cuneate, 4·2–4·5 cm. long, 2·3–3·3 cm. broad at the broadest point which is about one fourth of the total length from the apex. Flowers sessile, solitary, numerous, erecto-patent, alternate, arranged in a lax spike. Peduncle terminal, terete, of a purplish colour. Calyx-lobes short (about 1 mm. long). Corolla tubular, somewhat ventricose above the calyx, $\pm$ 8 mm. long; lobes erect or erecto-patent, $\pm$ 3 mm. long, acute." With this description to go by, especially that part relating to the flowers, it is difficult to understand how the above errors cropped up in Dr. Schonland's paper.

The following represents the revised synonymy for the species:

A. maculatus (*Salm Dyck*) *Lem.* in Jard. Fleur. II. Misc. 60 (1852), ex Berger in Engl. and Prantl, Nat. Pflanzenfam, Vol. 18, a. 416 (1930).

Cotyledon maculatus Salm Dyck, Obs. Bot. 5 (1820), ex Haw., Rev. Pl. Succ. 1821; Eckl. & Zeyh., Enum. No. 1973 (1836); Harv. in Harv. & Sond., Fl. Cap. II. 378 (1861–62); Baker in Saund., Ref. Bot. I. t. 35 (1869); Schonl. & Bak. f. in Journ. Bot. Vol. 40. 92 (1902).

C. alternans Salm Dyck ex Haw., Suppl. Pl. Succ. 26 (1819); non Willd. (1799).

A. mucronatus Lem. in Jard. Fleur. II. Misc. 60 (1852), ex Ind. Kew. & Berger (*loc. cit.*).

C. hemisphaerica Harv. in Harv. & Sond., Fl. Cap. II. 376 (1861–62), partim; non Linn. (1762).

SOUTH WESTERN REGION—Worcester distr.: " In aridis in convalle flum. Hex River, prope De Doorns, 1600 ped., Jan. 1908," *Bolus* 13044! (K.). Robertson distr.: Near Robertson Station, on the western slope of a rocky hill, associated with *Gasteria carinata* Haw. in shady places, April 1926, flowering at Division Plant Industry, Dec. 1926, *Smith in Nat. Herb.* 8875 ! (Pa).

CENTRAL REGION—Oudtshoorn distr.: In a poort on shale of the Bokkeveld series, between Oudtshoorn and Montagu Pass, April 1930, *van Nouhuys* ! *s.n.* (Pa).

2. A. triflorus (*Linn. f.*) *Berger*.

The type specimen of this species was collected by Thunberg " prope Zekorivier " [Zeekoerivier] in the Clanwilliam district, during Dec.–Jan. 1774–75, and a much more detailed and amplified description given by him (Fl. Cap. Ed. Schult. 396: 1823) than was first supplied by the younger Linnaeus (1781), and is here quoted for purposes of reference: " Caulis carnosus, crassus, herbaceus, glaber. Folia: inferne sessilia, crassa, obtusissima, subtruncata, inferne attenuata, basi teretiuscula, approximata, erecta, subincurva, glabra, bipollicaria, ultra pollicem lata, pallida viridia. Omnino referunt folia Cotyledonis orbiculatae. Flores subterni, spica longa, spithamea, rhachis angulata. Bractea sub singulo flore minuta. Perianthium monophyllum, 5-dentatum, erectum, viride, brevissimum. Corolla 1-petala, tubulosa; tubus cylindricus, striatus, viridi-rufescens, subunguicularis, glaber: Limbus 5-partitus patens: Laciniae ovatae, obtusae, intus albae, extus rufescentes, lineam longae. Filamentae 10, tubo inserta, paulum adnata, subulata erecta, viridia, tubo breviora. Antherae ovatae, minutae, flavae. Nectarii squamae 5, ad fundum germinis, subexcisae, albidae. Germina supera 5, subulata, glabra, viridia. Stigmata acuta. Capsula 5, subulata."

So far as is known, the species appears not to have been found since Thunberg's time, though a specimen described by Lemaire in 1852 (*loc. infra cit.*) as *Adromischus robustus* Lem., is regarded by Berger (*loc. infra cit.*) as conspecific with Thunberg's plant, though it is not known from what locality Lemaire had his plant(s). Both Salm Dyck (Obs. Bot. 6: 1820) and Haworth (Rev. Pl. Succ. 19: 1821) described what they took to be *C. triflora* Linn. f., but were guided probably more by the 3-florous condition of the cymules in the inflorescence of their plants, which these exhibited in common with Thunberg's specimen, and their erroneous identifications were perhaps natural in view of the inadequate diagnosis of *C. triflora* given by both the younger Linnaeus (*loc. infra cit.*) and Thunberg (Prodr. Pl. Cap. 83: 1794), which they must have consulted, since the latter's " Fl. Cap. Ed. Schultes " did not appear till 1823 (see also note under the next species, No. 3).

Then Harvey (2), for no clear reason, reduced *C. triflora* Linn. f., the type specimen of which he had seen, under *C. hemisphaerica* Linn., though he cites the typical plant of the latter as figured in Dill. Hort. Eltham. t. 95, f. 111 and DC. Hist. Pl. Grass. t. 87 ! The leaves of the former species, however, differ so profoundly in shape size and cross-section from those of the latter, that Harvey's reduction is wholly unwarrantable (see also note under No. 5).

A. triflorus (Linn. f.) comes closest to *A. sphenophyllus* (the next species), but differs from this in several characters, such as size and leaf-shape, colour of flowers and shape of its corolla-lobes, smaller and less excised nectarial scales, which taken in conjunction with its " western " distribution, as opposed to the " south-western " distribution of the other, have led the writer to keep the two species apart. The following embraces the synonymy treated above:

A. triflorus (*Linn. f.*) *Berger* l.c. (416).

Cotyledon triflora Linn. f., Suppl. 242 (1781); Murr., Syst. Ed. xiv. 429 (1784); Thunb., Prod. 83 (1794); & Fl. Cap. Ed. Schultes, 396 (1823); *non auct. alior.*

C. hemisphaerica Harv. l.c. 376, partim; non Linn. (1762).

A. robustus Lem. in Jard. Fleur. II. Misc. 60 (1852), ex Berger l.c.

WESTERN REGION—Clanwilliam Div.: Near the Zeekoerivier, Dec.-Jan., 1774–75, *Thunberg*. (Type in Herb. Thunb., Upsala).

3. A. sphenophyllus *C. A. Sm.*, nom. nov.

A dried specimen of the type gathering of the species, figured as *C. rhombifolia* Haw. in Saund., Ref. Bot. I. t. 36 (1869), is in Herb. Kew., having been presented by W. W. Saunders in 1877. In this the inflorescence is simple and the flowers singly disposed at the nodes. Cooper's original specimen, i.e. the wild plant (*Cooper* 2338! C. B. S., *sine loc. exact.*) is also in Herb. Kew., and the inflorescences mounted on the sheet show one with 1–, and the other with 1–3-flowered cymules. Neither, however, represents the typical form of Haworth's species (*v. seq.*), but they both match a fine coloured illustration (in the collection of drawings at Kew) of a plant which is, however, without inflorescence " received [as *C. triflora*] from the Prince of Salm in the year 1823," and against which N. E. Brown has noted : " This quite agrees with the leafy part of the specimen of *C. triflora* in Haworth's Herb. at Oxford. Compared Oct. 30, 1901." There can be no doubt that the specimen in Haworth's herbarium was sent him by Salm Dyck at the same time that the latter sent the specimen to Kew, and that they came from the same original gathering. This is further borne out by the fact that both Salm Dyck and Haworth describe " *C. triflora* Linn. f.", and their descriptions agree very closely, while there can be no doubt that also in inflorescence details the latter species [i.e. *C. triflora* Salm Dyck (non Linn. f.)] agrees with those in *C. rhombifolia* Baker (non Haw.), though the inflorescence of the former in Haworth's herbarium shows signs of having been injured by mechanical or biotic agencies. From the descriptions and specimens available, however, it would appear that the cymules may be 1–3-flowered in this species.

Since neither of the two specific names may validly be applied to the species under consideration, the following new name (with details of synonymy) is proposed for it under *Adromischus* :

A. sphenophyllus *C. A. Sm.*, nom. nov.

Cotyledon triflora Salm Dyck, Obs. Bot. 6 (1820) ; Haw., Rev. Pl. Succ. 19 (1821) ; Schonl. & Baker f. l.c. (91), non Linn. f. (1781).

C. rhombifolia Baker in Saund., Ref. Bot. I. t. 36 (1869) ; Schonl. & Baker f. l.c. (92) ; Schonl. in Rec. Alb. Mus. Vol. 3, 154 (1915), excl. syn. ; non Haw. (1825).

A. rhombifolius Berger l.c. (416) ; non *C. rhombifolia* Haw. (1825).

" C. B. S." (*sine loc. exact.*) : *Cult. spec. e Hort. Saund. leg. Cooper* ! Type (K) ; *Cooper* 2338! Syn-type (K).

CENTRAL REGION—Willowmore distr.: On hillside near Willowmore, anno 1931, *Steyn* ! *s.n.* (Pa).

N.B.—The specimen referred to under " C. rhombifolia Haw." by Schonl. & Baker f. (*loc. supra cit.*) as having " flowered at Grahamstown in the Spring of 1898 " no doubt belongs here.

4. A. rhombifolius (*Haw.*) *Lem. ex Berger.*

This species was originally described by Haworth (*loc. infra cit.*) from a non-flowering mspecien which was apparently never kept, since there is no plant so named in Haworth's herbarium at Oxford. From his description, however, there can be little doubt that the

specimen figured and described by Baker under the name *C. rhombifolia* in Saund., Ref. Bot. I. t. 36, is distinct in habit and shape of its leaves from Haworth's plant. Fresh specimens from between Oudtshoorn and Montagu Pass, and recently examined by the writer, agree perfectly with Haworth's description, so far as this goes, and serve still further to distinguish Baker's plant from the species under discussion. Unfortunately it has not been possible to give an amended description of the species from the fresh material available, but this defect may be rectified at a later date.

A. rhombifolius (*Haw.*) *Lem.* in Jard. Fleur. II, Misc. 60 (1852), *ex Berger*, l.c. 416, *quoad nom. sol.*

Cotyledon rhombifolia Haw. in Phil. Mag. 1825, 33 ; DC., Prod. Vol. 3, 398 (1828) ; Harv. l.c. 378 ; Schonl. l.c. 154, partim, et excl. syn.

Central Region—Oudtshoorn distr. : Between Oudtshoorn and Montagu Pass, 7 miles from North Station, in Bokkeveld series on outcrops of Table Mountain Sandstone, April 1930, *van Nouhuys* ! *s.n.* (Pa).

Originally described from specimens sent from the Cape to Kew by James Bowie in 1823, but there is no record so far known of where he collected his specimens, nor has a single specimen been kept.

5. A. hemisphaericus (*Linn.*) *Lem. ex Berger.*

This species has apparently never been correctly interpreted by monographers of the South African species of *Cotyledon* Linn. (sensu Fl. Cap.), except perhaps by Berger. It was originally based by Linnaeus on a Dillenian figure—Hort. Eltham. t. 95, f. 111 (1738), where it is named as "Cotyledon Capensis, folio semiglobato." According to Druce and Vines (Dillen. Herb. 165 : 1907), there is no specimen of the species in the Dillenian Herbarium at Oxford, nor is there such a specimen either in Herb. Cliff. or Herb. Linn. in London, but Dillenius' figure (which thus represents the type figure) is accompanied by such an excellently drawn up description of the plant that, in view of the statement in the first sentence above, this description is here given in full, the more so since the original work may not readily be accessible to others : "Cauliculi carnosi lenti sunt, non recta protensi, sed incurvi & pleurumque tortuosi, laeves, spadicei, variis lineis cinereis, nunc rectis, nunc transversis, nunc inaequali ordine connexis distincti, quibus hinc inde folia singularia, in summitato vero plura temere apposita sunt, levi tactu decidentia colorem, tenuibus punctis undique notata, crassa ; inferius, seu ad basim cauliculorum, rotundiora, superius seu versus summitatem magis plana, lenius nempe parte interiori elevata, exteriori vero, ut in illis, protuberante & pulvinata, succulenta, sapore acerbo & adstringente praedita.

"A palmari ad dodrantalem & pedalem subinde nascitur altitudinem, & caules carnoso-lignosos, magis ramosos, acquirit, sed longo temporis spatio indiget, ut adhanc altudinem perveniat ; lente enim nascitur, & facile ob succositatem putrescit.

"Porro flores aegre fert, nec eos una vice amplius vidisse memini, eosque imperfectos : scapus erat dodrantalis subteres, glaber, obsolete virescens, secundum cujus longitudinem gemmae quaedam tenues, in summitate vero flores oblonges sex septemve nascebantur, quinque lineis impressis notati, virescentes, in extremitate purpurascentes, calyce monophyllo, in quinque laciniae diviso excepti, & hujus ope scapo annexi, tenui ligula ab basim praedita, qui quales suturi essent, dicere non habeo, cum apertos videre non contingerit. . . . Haec Augusto mense observare licuit."

Two other published figures of the above species, both in colour and both correctly identified specifically, are known to the writer : Roth, Bot. Abhandl. & Beob. t. 6 (1787) and DC., Hist. Pl. Grass. t. 87 (1799–1829).

Roth's figure is excellent for the habit and leaves of the plant and typical of the species as represented by the type figure. He figures the flowers, however, as being borne in sessile pairs among the apical leaves on the short and podgy lateral upper branches of the stem, and does not give a detailed description of the plant in the text, but in the index to the plates in the work he describes the flowers as "in capituli speciem collecti, quorum bini hic [i.e. in the plate] conspiciuntur," and "initia forte spicatum, quae tamen absque mutatione molis perierunt." The young inflorescence is frequently (especially in cultivated specimens) injured by aphids, and so gives rise to various teratalogical forms, such as suppression of the main axis of the inflorescence, oppositely borne 1-6-flowered cymules, etc. Hence the condition figured by Roth.

De Candolle's exquisite plate again is perfect for the species, though not illustrating the characteristic habit so well as Dillenius' or Roth's figure does, but showing the shape, colouration and papillose texture of the leaves exceptionally well, these being further described as "sparsa, sessilia, ovato-rotunda, subtus valde convexa et inde semiglobata, subobtusa, pinguia, glabra, furfure punctata."

In the Kew collection there is a fine coloured illustration of the type plant of *C. cuneiformis* Haw. (Phil. Mag. 1828, 185), which is noted as "Received from the Cape of Good Hope in 1823 from Mr. Bowie." Though not in flower at the time of figuring, the plant agrees in all essential vegetative characters with the three plates of *C. hemisphaerica* Linn., and there can be very little doubt that Haworth's plant is conspecific with the latter.

None of these plates presents any difficulty since they clearly represent one and the same plant, yet so consistently has the species under review been misinterpreted by various authors that one can only conclude that (excluding for the moment Haworth's and Roth's figures as being less readily accessible) the Dillenian and De Candollean plates were never properly referred to. Thus Schonland ([3]) reduces "*C. triflora* Linn. f." and "*C. rotundifolia* Haw.", both of which he had wrongly interpreted, under "*C. hemisphaerica* Linn.", also stating (*loc. cit.* 153) that *C. nana* N. E. Br. "evidently [*sic!*] belongs to this species though it has only a one-flowered peduncle," and this in spite of the very different and distinctive type of flowers produced by the latter and the conspicuous blotching of its leaves. Of Haworth's *C. rotundifolia* there is an exact drawing in the Kew collection of drawings (a photo of the type specimen is given in Journ. Bot. Vol. 40, t. 435), and comparison of this taken in conjunction with the existing descriptions of the species, indicates clearly the very distinct specific differences between *C. rotundifolia* Haw. and *C. hemisphaerica* Linn. The differences in foliage characters may best by illustrated by cross-sections as shown in the following figure :

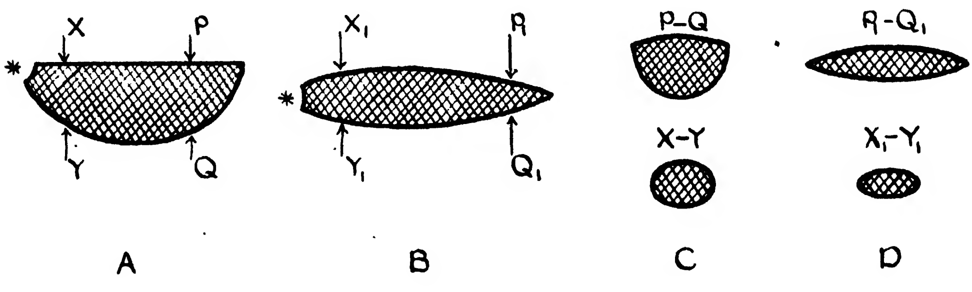


FIG. 2.—A. Median longitudinal section through the fresh leaf of *A. hemisphaericus* (Linn.), with transverse sections in the regions X—Y and P—Q indicated by C; B. Median longitudinal section through the fresh leaf of *A. rotundifolius* (Haw.), with transverse sections in the regions X_1—Y_1 and P_1—Q_1 indicated by D. The base is marked by an asterisk.

[*C. triflora* Linn. f. similarly differs from *C. hemisphaerica* Linn. in having leaves which are flat, i.e. their thickness in the anterior half (as seen in cross-section) much exceeds the breadth, apart even from the fact that they are opposite in that species and its flowers are arranged in 3-flowered cymules along the inflorescence rhachis.]

Harvey [1] also reduces *C. triflora* Linn. f. (of which he had actually seen the type, and which he cites as of " Thunb. Fl. Cap. p. 396 ") under *C. hemisphaerica* Linn., and in this he may have been followed by Schonland, but from the previous paragraph it is evident that this reduction is quite untenable. From the fact that Harvey describes the leaves as " flat, 1–2 inches long, 1–1½ inches wide," as well as other details, it would appear that he based his description of " *C. hemisphaerica* Linn." for the greater part on the type specimen (Thunberg's) of *C. triflora* Linn. f. and Ecklon & Zeyher's specimens of *C. maculata* and *C. rhombifolia.* Baker had also, as far back as 1869, pointed out that Harvey's synonymy for *C. hemisphaerica* Linn. was erroneous, correctly laying stress on the shape, relative size and colouration of the leaves of the latter species, of which he had himself seen live cultivated specimens as well as de Candolle's fine plate above noted, though Baker, like Harvey, omitted to note the all important fact that in *C. hemisphaerica* Linn. the leaves are alternate, and opposite in the other three species regarded as conspecific with it.

The writer has also examined the type plant of *C. nana* N. E. Br. (see No. 12) at Kew and cannot endorse Dr. Schonland's statement previously quoted. In habit and foliage it approaches *C. maculata* Salm Dyck, but its leaves are alternate, while its floral characters, as noted above, readily remove it from the group to which *C. hemisphaerica* Linn. belongs.

The revised synonymy for the latter species would then be as follows :

A. hemisphaericus (*Linn.*) *Lem.* in Jard. Fleur. II, Misc. 60 (1852), *ex Berger*, l.c. (416).

Cotyledon hemisphaerica Linn., Sp. Pl. Ed. ii. I. 614 (1762) ; Roth, Bot. Abhandl. & Beob. t. 6 (1787) ; Willd., Sp. Pl. II. 756 (1799) ; DC., Hist. Pl. Grass. t. 87 (1799–1832) ; Dryand. in Ait., Hort. Kew. Ed. ii. III. 109 (1812) ; Haw., Syn. Pl. Succ. Ed. Germ. 116 (1819) ; Harv. l.c. (376), *pro minime parte, excl. syn. Thunb., E. & Z., et spec. Zeyh. et Drège ;* Baker in Saund., Ref. Bot. I. sub. t. 36 (1869), in obs. ; Schonl. l.c. 152, *pro minime parte, et excl. syn. Linn. f. et Haw.*

C. cuneiformis Haw., in Phil. Mag. 1828, 185.

Cotyledon capensis foliis semiglobosis Dill., Hort. Eltham. t. 95, f. 111 (1738).

The writer has so far not seen a single dried or living specimen of this interesting species, which is historically the oldest in the genus, and no one appears to have re-discovered the plant during the last 70 odd years.

E. & Z. (Enum. 307 : 1836) quote their No. 1970 as " C. hemisphaerica Linn.", and as being collected " inter saxa . . . laterum montis ' Leeuwenberg ' (Cap.)," but the writer has not seen these specimens, and believes these to belong to *A. rotundifolius* (Haw.), the next species, of which specimens have been collected in the same locality (=Lions Head).

6. A. rotundifolius (*Haw.*) *C. A. Sm.*, comb. nov.

There is an accurate drawing of Haworth's type in the collection of drawings at Kew, a fair photographic reproduction of the type being also given by Schonl. & Bak. f. [4]. These authors state (*loc. cit.* 91) that this species is " probably not specifically distinct from *C. hemisphaerica* Linn.", but that " the leaves are broader, branches less erect, and the caudex thicker " than in the latter. The last two characters are of doubtful value, since the branches in typical specimens of *C. hemisphaerica* Linn. are frequently spreading and the caudex up to 3 cm. in diam. The leaves, however, afford the best and most ready characters for distinguishing between these two species (see Fig. 2, and note under previous species), those of the latter being semiglobose and not obovate to rotund and flat.

The following notes made from Haworth's type by the above two authors will serve to supplement Haworth's description: "Leaves subrotund, apex rounded, margin sometimes somewhat undulate, 2·5–3·5 cm. long, 2–2·5 cm. broad, glabrous. Flowers subsessile, solitary or rarely in twos, patent or erecto-patent, spicato-racemose. Calyx-lobes deltoid, short, about 1 mm. long. Corolla tubular, tube ± 1·1 cm. long, lobes ovate, subacuminate, finally reflexed or subreflexed." In addition may be given the following details drawn up from fresh specimens cited below and collected by the writer: "Succulent perennials growing socially in close masses between rocks and in fissures of rocks and other crevices, usually in shady situations. Stems several from the crown of the rather shallow growing fibrous root system, or single, usually very short and stout, with or without short stubby branches which bear the leaves, rigid, terete, with numerous more or less concave protuberances marking the old leaf bases and thus giving the stems an irregular outline, leafy only in the upper third, and covered with a thin chartaceous greyish skin, glabrous. Leaves alternate, scattered, very fleshy, suborbicular to obovate or obovate-cuneate, always rounded at the flat or slightly crinkled apices, thickest at the flattened expanded base, becoming thinner towards the apex, greyish-green in colour and unspotted."

A. rotundifolius (*Haw.*) *C. A. Sm.*, comb. nov.

Cotyledon rotundifolia Haw., in Phil. Mag. 1827, 273; Schonl. & Bak. f. l.c. 91; R. A. Dyer in Bot. Mag. t. 9368 (1934).

C. hemisphaerica Harv. l.c. 376, *partim*; Schonl. l.c. 152, *partim*; non Linn (1762).

C. Bolusii Schonl, l.c. 59.

A. Bolusii (Schonl.) Berger l.c. 416.

A. hemisphericus, Jacobsen, Succ. Pl. (Engl. trans.), 17 (1935); non Lem.

South Western Region—Cape distr.: Rocky crevices on west side of Lion's Head, above Capetown, *Wolley Dod* 2279! (K). Stellenbosch distr.: In fissures of rocks and in crevices between rocks on the western slopes of the Hottentots Holland Mountains at Sir Lowry's Pass, near the tunnel, March 1931, *Smith* 6000! (Pa) *et spec. cult.* (Pa).

Here may probably also be referred *Cooper* 3628! (C. B. S., *sine loc. exact.*), preserved in Herb. Kew.

This is the only species of the genus so far known, to reach the Cape South-West (see also last paragraph under the preceding species).

7 A. caryophyllaceus (*Burm. f.*) *Lem.*

This is one of the earliest known species of the genus, being fairly well figured and described by the elder Burmann in his Rar. Pl. Afr. p. 39, t. 17, published in 1738, a year after Dillenius published his figure of *C. hemisphaerica*, and specifically named by the younger Burmann in 1768 (see also p. 615). It still remains, like the latter, one of the rarest of South African plants, having apparently been collected only twice since 1738. In 1818 Salm Dyck had it from the Cape and described it as *Cotyledon jasminiflora* Salm Dyck (Obs. 30: 1820), under which name Haworth also received it about the same time from Salm Dyck, neither recognising the much earlier name for the species in Burmann's *C. caryophyllacea*. And it was not until *c.* 1878 that Bolus rediscovered the plant "in fissuris rupium in monte Tandjiesberg, prope Graaff-Reinet," and for the first time definitely identified the wild plant with that figured by Burmann nearly a century and a half earlier. Schonland and Baker fil. were the first to point out, however, as a result of examining Haworth's specimens of *C. jasminiflora* Salm Dyck in his herbarium at Oxford (1902), that the latter plant was conspecific with *C. caryophyllacea* Burm. f., both these specific names being referred to by Harv.(²) under the heading of "Imperfectly known and doubtful species" of *Cotyledon*.

In as much as no complete description has as yet been drawn up from living specimens of the species, Burmann's original account is here given in full for purposes of ready reference and convenience: " *Cotyledon foliis ad genicula plurimis planis, oblongis; floribus gemellis, erectis, Caryophyllaeis.* Ex plurimis fibrillis tenuibus, flexuosis, intricatis, nigricantibus, ex uno centro prorumpentibus oritur caulis unus alterve, qui in ejus summo folia gerit plurima collecta, & ex uno quasi centro provenientia, quae sunt plana, obliqua, ex tenuiori basi in latum apicem desinentia, crassa, venosa, glauca, limbo purpureo; ex horum centro erigitur caulis florifer tenuis, rotundus, viridis, qui ultra dimidium divaricatur, & in ejus summo gerunt flores utcunque gemellos, singuli tamen suo petiolo proveniunt; suisque calicibus tenuibus, oblongis, quinquefidis continentur; flores hi sunt tenues, oblongi, tubulosi, forma fructus Caryophylli arboris referentes, in summo quinquefidi, segmentis planis, angustis, acutis carneis, in singulo segmento linea rubra distinctis, seu variegatis. Post hos sequuntur fructus teretes, in quinque loculamenta perpendiculariter sissi, quinqueloculares, in singulo loculo continentes semina minima subrotunda, fusca ". In addition to the above the following notes, made by Schonland and Baker fil.(4) from authentic specimens in Haworth's herbarium, will serve to amplify Burmann's description: " Stem rather thick, branching, 6·0 cm. long, suffrutescent. Leaves fleshy, oblanceolate or oblong-spathulate (convex above, rounded below, thickish), green, shining, 1·3–3·0 cm. long, and ·9–1·3 cm. broad at the broadest part, obtuse. Scape 13–15 cm. long, 4-6-flowered, sometimes the scape branches, and branches reach 5·5 cm. long, ascending. Pedicels sometimes rather short, thickened obclavate, 3–5 mm. Flowers erect, with a green tube and a revolute purple and white limb. Calyx lobes triangular, acute, 1·5 mm. long. Corolla tube 1·4 cm. long, lobes ovate acute, nearly 5 mm. long. Stamens included. Squamae longer than broad ".

The joint authors of these notes (*cit. i f.*) regard this plant to be allied to *C. hemisphaerica* Linn. " in the structure of its flowers ", but the flower is almost exactly that of *C. rotundifolia* Haw. (the previous species), *C. maculata* Salm Dyck, etc., which all certainly have the same fundamental floral structure as that of *C. hemisphaerica* Linn., but the flowers are much larger in size and of quite different colouration than those of this species. On the whole this is one of the most well marked species in the genus, with a possible affinity, as far as habit and floral characters are concerned, with *C. rotundifolia* Haw. The following synonymy must supplant that so far given by authors:

A. caryophyllaceus (*Burm. f.*) *Lem.* in Jard. Fleur. II., Misc. 60 (1852) ex Berg. l.c. 416.

Cotyledon caryophyllacea Burm. fil., Prod. Fl. Cap. 13 (1768); DC., Prod. III. 398 (1828); Harv. l.c. 378, Schonl. & Baker f. l.c. 93; Schon. l.c. 151.

C. jasminiflora Salm Dyck, Obs. 38 (1820); Haw., Rev. Pl. Succ. 20 (1821); DC., Prod. III. 398 (1828); Harv. l.c. 378.

A. jasminiflorus (Salm Dyck) Lem. in Jard. Fleur. II. Misc. 60 (1852), ex Berger l.c. 416.

C. foliis ad genicula plurima planis, oblongis; floribus gemellis, erectis, caryophyllaeis, Burm., Rar. Afr. Pl. 39, t. 17 (1738).

" C. B. S." (*sine loc. exact.*): *Cult. spec. e Hort. Dyck.* ! Type, in Herb. Haw. Oxon.

Central Region—Graaff-Reinet distr.: In rocky fissures on the slopes of the Tandjiesberg, near Graaff-Reinet, anno 1878, *Bolus* 758 ! (K).

Bolus states that the plant is extremely rare.

Cotyledon mammillaris *Auct. non Linn. f.*

Schonland ([3]) considers the plant figured in Bot. Mag. t. 6020 as representing the typical *C. mammillaris* Linn. f., but, in as much as Thunberg (Fl. Cap. Ed. Schult. 397) describes the stem as "repens, radicans, . . . crassitie dimidia calmi . . . " and the leaves as "secunda, verticellata, instar mammillae . . . unguicularia . . .", the corolla-tube as "viridis . . . unguicularis" and the limb as "plicatus . . . albido-purpureus . . .", there can be no doubt that the Botanical Magazine plant (description below) is quite distinct from the species described by Linneaus fil. and is thus without a valid name, unless either of the two synonyms cited by Schonland (*loc. supra cit.*), viz. *C. filicaulis* E. & Z. and *C. Marlothii* Schonl., may be resuscitated for the Botanical Magazine plant, this depending on whether these plants are conspecific with the latter.

A comparison of Harvey's ([2]) description of *C. mammillaris* Linn. f. with that of the type of this name as given by Thunberg (*loc. supra cit.*) immediately shows that Harvey must have described almost exclusively from *E. & Z.* 1975, the type of *C. filicaulis* E. & Z., cited by Harvey as a synonym of the former, and *Zeyher* 2897. Thus Harvey gives "stems very short or scarcely any; leaves crowded round the apex, or scattered along the short stem . . . 1½–2 inches long", and these details certainly exclude the specimens cited from *C. mamillaris* Linn. f. Moreover, the two species come from very different botanical areas—the former from the Khamiesberge in Little Namaqualand, and the latter from the Oudtshoorn div. in the southern limits of the Central Region, and from the latter, as well as from the Robertson district the writer has seen a number of fresh specimens which agree perfectly in every detail with Thunberg's description of his type specimen of *C. mammilaris* Linn f. but certainly not with the Ecklon and Zeyher type material. The latter also differs very markedly from the Botanical Magazine plant in its very much dwarfer habit, much shorter racemose inflorescence in which the flowers are borne in 1-flowered cymules at the nodes, and in the colour of its flowers. Hence *C. filicaulis* E. & Z. ranks as a species by itself which, under *Adromischus* Lem. will bear the following name (with details of synonymy):

8. **A. filicaulis** (*E. & Z.*) *C. A. Sm.*, comb. nov.

Cotyledon filicaulis E. & Z., Enum. 307 (1836).

C. mammillaris Harv. l.c. 377, *pro majore parte, sed excl. syn. Thunb., et DC., non Linn. f.*

Western Region—Namaqualand Minor: Sides of the Khamiesberge, *Ecklon and Zeyher* 1975, type (Herb. Sond.); near Springbokkuil, *Zeyher* 2897! (Herb. Sond.).

C. Marlothii Schonl.([3]) was described by its author from specimens gathered at Laingsburg (Central Region) by the late Dr. R. Marloth in 1902. In habit and leaf shape it comes nearest to *C. filicaulis* E. & Z., from which it differs among others in the shape of its leaves, differing also from *C. mammillaris* Linn. f. in the same characters already noted for the former, as well as in habit. In this character, too, it resembles *C. hemisphaerica* Linn., but differs from this in its fusiform terete leaves. From the Botanical Magazine plant it differs by its very much shorter racemose inflorescence in which the flowers are singly borne at the nodes and differently coloured, and by its much dwarfer habit. Berger ([1]) was therefore correct in regarding *C. Marlothii* Schonl. as a distinct species under *Adromischus* Lem.:

9. **A. Marlothii** (*Schonl.*) *Berger* l.c. 416.

Cotyledon Marlothii Schonl. l.c. 59.

C. mammillaris Schonl. l.c. 153, *in part. non Linn. f.*

Central Region—Laingsburg distr.: Near Laingsburg, July 1902 (*flor. in Hort. Alb. Mus.*, Feb. 1903), *Marloth* 1520! Type (Herb. Alb. Mus.).

The Botanical Magazine plant thus appears to be distinct from all three species treated above, and must therefore under International Rules have a new name, for which the following, with details of synonymy, is proposed:

10. A. kleinioides *C. A. Sm.* nom. nov.

Cotyledon mammillaris Hook. f. in Bot. Mag., Vol. 99, t. 6020 (1873); Schonl. l.c. 153, *partim ; non Linn. f.*

Stem up to 50 cm. high and 2 cm. thick, ascending erect or ascending, sparingly branched, with decurved tips, glabrous. *Leaves* alternate and scattered, spindle-shaped, acute, narrowed to a broad base, up to 6 cm. long and 1·3 cm. thick, terete, glaucous-green, glabrous. *Spike* up to 30 cm. long, at length pendulous, glabrous in all parts; flowers in 3-flowered nodal cymules in the lower part, with only the middle flower evident in the younger stages of development in the upper part, the lateral flowers strongly divergent. *Corolla-tube* dull yellowish-green or brown, up to 1·5 cm. long; limb dull reddish-brown, on both surfaces, up to 6 mm. in diam., spreading-reflexed, with the lobes undulate and furnished with long apical subulate processes. *Nectarial scales* minute, orbicular and notched.

WESTERN REGION--Namaqualand Minor (*without precise locality or collector*).

This exceedingly handsome species is thus far apparently known only from the fine coloured plate in the Botanical Magazine, the original specimen not being kept.

11. A. mammillaris (*Linn. f.*) *Lem. ex Berger.*

It is difficult to understand how this species, even though considered only from Thunberg's fairly detailed description, could have been confused with the three preceding (see also notes under these), so that for purposes of ready comparison with the notes made under them, the original description of the type by Thunberg (though first shortly described and named by the younger Linnaeus) is here given in full: " *Caulis* repens, radicans, carnosus, teres, glaber, crassitie dimidia calmi, ramosus, cinereus. *Folia* subpetiolata, secunda, verticellata, instar mammillae, utrinque attenuata, obtusa, carnosa, unguicularia, cinerea. *Pedunculus* longus, filiformis, spithameus. *Flores* patentes, subpedunculati; pedunculi breves. *Tubus* cylindricus, angulatus, viridis, glaber, unguicularis. *Limbus* 5-lobatus, plicatus, patenti-reflexus, albido-pupureus, vix lineam longus. *Filamenta* 10, quorum 5 longitudine tubi et 5 breviora, tubo inserta, capillaria, albida. *Antherae* minutae, ovatae, pallidae. *Stigmata* 5, truncata. *Styli* 5, subulati, longitudine staminum, breviorum. *Capsulae* quinque."

A. mammillaris (*Linn. f.*) *Lem.* in Jard. Fleur. II, Misc. 60 (1852), *ex Berger*, l.c. 416.

Cotyledon mammillaris Linn. f., Suppl. 242 (1781); Thunb., Prod. 84 (1794); & Fl. Cap. Ed. Schult. 377 (1823); DC., Prod. Vol 3, 398 (1828); non Haw. (1821).

CENTRAL REGION—Oudtshoorn distr.: " Olifantsbad ", Dec., *Thunberg*! Type (Herb. Upsala); in a poort on Bokkeveld series, between Oudtshoorn and Montagu Pass, April 1930, *van Nouhuys*! *s.n.* (Pa). Robertson distr.: On karoo-like hills, near Robertson, March, *Galpin* 10334! (Pa). Ladismith distr.: On hills near Ladismith, Dec. 1926, *Liebenberg* 620! (Pa).

N.B.—The plant (*Herb. Norm. Austro-Afr.* 1860!) distributed by Macowan as " C. mammillaris L. f.", is *A. Marianae* (Marl.) Berger.

The leaves of the above species are unspotted, Berger (*loc. cit.*) erroneously placing the species in his key under the group with richly spotted leaves, and so close is the resemblance of the plant in habit and foliage to some specimens of *Kleinia radicans* (Thunb.) Haw. [Phil. Mag. Vol. 62. 381 (1823)] and *K. gonoclada* DC. (Compositae), that distinction between non-flowering specimens of these species is nearly impossible. In the fresh condition, however, the species are readily distinguished by the turpentine-like flavour of the broken leaves of the two species of *Kleinia* and the pale greyish-green longitudinal band which marks their " midrib." These characters are not met with in *A. mammillaris* (Linn. f.).

The inflorescence described in detail by Haworth (Rev. Pl. Succ. 21 : 1821) as belonging to *C. mammillaris* is clearly that of another species of *Cotyledon*. This inflorescence, which Haworth had " ex horto regio Kewense . . . in Junio 1819 ", showed the following outstanding features : " *Flores* terminales in racemo 3–4-floro parum paniculato . . . *Pedunculi* graciles 6–12 lineares, erecti nutantesve, cum calycibus uti corollis, ramenatceo-pubescentes . . . *Corolla* ventricosa . . . sordide fulvescens, laciniis 5 subrevolutis acutis . . . *Filamenta* 10, sordide flavescentia, lente villosa . . . "—characters which agree perfectly with those observed in the inflorescence of typical *Cotyledon ventricosa* Burm. f.

12. A. tricolor *C. A. Sm.*, sp. nov.

Planta perennis, succulenta, in omnibus partibus glabra. *Caules* breves (ad 3 cm. alti, ut videtur), crassi, simplices. *Folia* opposita et decussata, oblongo-cylindrica ad oblongo-elliptica, teretes, ad basin molliter angustata, apice subobtusa, ad 6 cm. longa et 7 mm. lata, carnosa, in medio parte crassissima, cinereo-viridia sed maculis purpureo-brunneis omnino notata. *Inflorescentia* terminalis, spicata, simplex, vel 1–2-ramosa ; rhachis rigida, erecta, ad apicem subcernua, ad 25 cm. longa (pedunculus inclusus) ; ramuli ascendentes, breves, pauciflori. *Flores* in cymulis 1-floris laxe dispositi, bracteis patentibus lanceolato-subulatis membranaceis. *Calyx* carnosus, viridis ; dentes ovato-deltoidei, acuminati, ad. 1·5 mm. longi, saepe post fructus persistentes et spinescentes. *Tubus corollae* cylindricus, rectus, obscure 5-angulatus, ad 1·5 cm. longus, viridis ; lobi ovato-lanceolati, acuminati, superne albi vel purpureis suffusi, inferne rubri ; limbus patens, deinde subreflexus. *Ovaria* oblique-ovata, in stylo subulato longe angustata. *Squamae nectarii* obovato-cuneatae, e marginatae, plus minusve dentibus calycis aequantes.

Western Region—Clanwilliam distr. : On dry hills near Brandvlei, 1,200 ft., Jan. 1896, *Schlechter* 9933 ! Type (Pa).

13. A. Cooperi (*Baker*) *Berger*.

First described from material collected by Thomas Cooper on the Zuurberg Range (Uitenhage distr.) in 1860, and so far apparently known only from the excellent type figure in Saunders' Refugium Botanicum, Vol. I. t. 72 (1869), made from Cooper's specimens which flowered at Reigate. It is certainly one of the most distinct in the genus, being characterised by its terete or subterete leaves which are markedly blotched all over and uniquely flattened into a broader ovate-rotundate (" spathulately dilated ", Baker) spotted apical portion, and by the beautiful wine-red corollas with little papillae on the upper face of the basal parts of the lobes. Yet Schonland and Baker f. (*loc. infra cit.*) suggest that it " may only be a varitey of *Cotyledon maculata* Salm Dyck " ! of which incidentally Schonland had anything but the correct conception (see note under No. 1). It is far more nearly allied to the next species and *A. festivus* C. A. Sm., the next but one, but from the former it is readily known by its spotted opposite leaves, while the latter differs in the curious apical portion of its alternate leaves, as well as in floral characters—wider and shorter corolla-tube, differently coloured parts, and absence of papillae.

A. Cooperi (*Baker*) *Berger*, l.c. 416.

Cotyledon Cooperi Baker in Saund., Ref. Bot. I. t. 72 (1869) ; Schonl. & **Bak.** f. l.c. 91 ; Schonl. l.c. 153.

South Eastern Coastal Region—Uitenhage distr. : On the Zuurberg Range, anno 1860, ***Cooper*** ! *s.n.* Type (*ic. col. tant. vidi*).

14. A. pachylophus *C. A. Sm.*, sp. nov.

Cotyledon Cooperi var. *immaculata* Schonl. & Bak.f. l.c. 92.

Planta perennis, succulenta, in omnibus partibus glabra. *Radices* ab eis origionibus tuberosi, in ramulis fibrosis angustati. *Caules* breves (ad 3·5 cm. alti) crassique (ad 1·3 cm. diam.), simplices vel ad apicem bifurcati ramulis brevissimis crassis, ad apices foliosi. *Folia* 4–6 alterna et subdecussata, laxe disposita, oblongo-cylindrica sed ad basin in parte breve terete crasso abrupter angustata instar petiolata, et tertia parte superiore in apice ovato-rotundata ad 3·5 cm. lata obtusa immaculata depressissima et expansa, ad 7 cm. longa, carnosissima, glauco-viridia, immaculata. *Infeorescentia* laxe spicato-racemosa, ad 30-flora; rhachis simplex vel ramosa, erecta, ad 30 cm. longa (pedunculus inclusus). *Flores* sessiles vel subsessiles, in cymulis 1-floris laxe dispositi, bracteis patentibus deltoideo-acuminatis membranaceis. *Calyx* subcylindricus, carnosus, glauco-viridis; dentes ovato-acuminati, ad 2 mm. longi. *Tubus corollae* cylindricus, rectus, ad 1 cm. longus, viridis sed superiore dimidia parte pallido rubro suffusus; lobi ovati, acuminati, ad 4 mm. longi, epapillosi, pallidi rubri. *Ovaria* 4–5, obliqueter oblonga, in stylo subulato longe angustata, stigmatis capitatis. *Sqeuamae nectarii* obovato-cuneatae, emarginatae, dentibus calycis in dimidio parte aequantes.

Central Region—Graaff-Reinet distr.: Mountain side near Graaff-Reinet, Nov. 1897, *Rattray*! *s.n.* Type (*cult. Hort. Alb. Mus. annis sequentis*). Queenstown distr.: On Bowker's Kop, near Queenstown, 3,800 ft., Nov. 1896, *Galpin* 2209! (Pa).

Galpin's material here cited showed one of the uppermost leaves on each of the specimens on his sheet, and these were distinctly smaller than the dimensions given by Schonland and Baker f.(1) for the leaves of their material. In other details, however, Galpin's specimens agreed very well with the rather scanty details given by the authors cited, and the writer has little doubt as to the conspecificity of the Rattray and Galpin specimens. Both localities should again be combed for additional material for purposes of verification, and for further amplifying the description. In the above, inflorescence details and basal parts were taken from Galpin's specimens and the leaves only described from the Rattray plant.

This species is most closely allied to the previous one, but from this it is readily known by its unspotted alternate leaves of which the apical crest is far more markedly expanded, and by the epapillose bases of the corolla lobes.

15. A. festivus *C. A. Sm.*, sp. nov. (Fig. 3).

Planta perennis, succulenta, in omnibus partibus glabra, sed omnino pulvo albescente (Anglice " bloom " dicta) tenuiter obtecta. *Caules* robustus, ad 4 cm. alti, sed speciminibus cultis multo altior et saepe ad basin foliorum nodis radices adventitiones emittentes. *Folia* opposita decussataque, ovoideo-cylindrica, gradatim et obtuse ad basin tertia parte inferiore in parte breve multo angustiore terete circa 5 mm. longe angustata instar crassiter petiolata, deinde abrupter in amplio basi amplectente expansa, molliter ad apicem deltoideum vel rotundatum vel obtusum saepe crispulatum maculatum depressissimum attenutaa, ad 5 cm. longa et 1·5 cm. lata, carnosissima, teretia vel subteretia, cinereo-viridia, maculis purpureo-brunneis pulchriter omnino notata (maculae frequenter infra apicem mergentes), patenti-ascendentia et saepe incurvata. *Inflorescentia* laxe spicata, simplex; rhachis erecta, ad 35 cm. longa (pedunculus inclusus). *Flores* in cymulis 1-floris laxe dispositi, braceteis deltoideo-ovatis acuminatis membranaceis. *Calyx* viridis, carnosus, cupuliformis; dentes deltoidei, subacuminati, ad 1·5 mm. longi. *Tubus corollae* cylindricus, viridis vel brunneo-viridis, ad 8 mm. longus; lobi ovato-acuminati, ad 2 mm. longi, superne alba vel pallido roseo suffusi, inferne rubri. *Ovaria* semi-ovoidea, longe in stylo acuminato angustata; stigmata capitata. *Squamae nectarii* obovato-cuneatae, emarginatae, calycis dentibus subaequantes.

Fig. 3.—*A. festivus* C. A. Sm. (see text).

Central Region—Graaff Reinet distr.: Near Graaff Reinet, on slopes of rocky hill above the reservoir, April 1926 (flowering at the Division of Plant Industry, Dec. 1926), *Smith in Nat. Herb.* 8876 ! Type (Pa).

The accompanying plate (Fig. 3) was made from the type specimen at the time of flowering (Dec. 1926).

The type agrees exactly with a photograph of a specimen cultivated by the late Dr. N. E. Brown in his conservatory ay Kew during July 1920, and sent by him to the Division of Plant Industry, Pretoria, sometime after the specimen had flowered in January of the following year, together with the name which is here taken up for the first time.

It is most closely allied apparently to *A. Cooperi* (Baker), but may be readily known from this by the shape and colouration of the leaves and their different apices, as well as the absence of the peculiar papillae on the corollas of its ally.

16. A. Zeyheri (*Harv.*) von Poellnitz in Cactus Journ., 1938, 68.

This species was regarded by Berger (1) as conspecific with *C. cristata* Haw., probably following on a note by Schonl. & Baker f.(4). The absence, however, of the very characteristic shaggy reddish aerial roots from the stems and the pubescent peduncles and corollas easily serve to distinguish it from the latter. The stems of the type plant are also "half-recumbent, rooting at the nodes" (Harv.), a condition not observed in *C. cristata* (Haw, so that the plant will bear the following name under *Adromischus* Lem.:

A. Zeyheri (*Harv.*) von Poellnitz l.c.

Cotyledon Zeyheri Harv. l.c. 397 : Schonl. & Baker f. l.c. 91 ; Schonl. l.c. 155.

South Western Region—Swellendam distr.: "Rocky places on the Kenko Rivier, east of the Buffeljachts Rivier", *Zeyher* 2571 ! Type (Herb. S. Afr. Mus.).

Schonl. and Baker f. also cite *Rattray* (*sine num.*) from Graaff-Reinet and *Schonland* 709 from "rocky places near Grahamstown" under the above species, stating "they have been compared with *Zeyher*, no. 2571, . . . and also with the type of *C. cristata* Haworth (Phil. Mag. 1827, 274), and we think these two species should be united".

The differences between the two species have been indicated above, and the writer has no hesitation in referring the two specimens just cited to *A. cristatus* (Haw.) ; *v. seq.*

17. A. cristatus (*Haw.*) *Lem. ex Berger.*

See also note under the previous species for distinguishing features between it and *A. Zeyheri* (Harv.), and under the following species for other differences between it and *A. clavifolius* (Haw.), with both of which it has been confused. Thus, as previously noted, Schonland and Baker f. (4) unite it with *A. Zeyheri* (Harv.)—as species of *Cotyledon*. However, so doubtful was Schonland himself of this that in his last paper on *Cotyledon* (3) he resuscitates *C. Zeyheri* Harv., but unites *C. clavifolia* Haw. with *C. cristata* Haw., keeping up the latter name. The following are the full details of synonymy and citations for the species under *Adromischus* Lem.:

A. cristatus (*Haw.*) *Lem.* in Jard. Fleur. II, Misc. 60 (1852), *ex Berger*, l.c. (416), *excl. syn. Zeyh.* Jacobsen, Succ. Pl. (Eng. trans.), 17 (1935), incl. fig. 2 sed excl. syn. *C. Zeyheri* "Haw."

Cotyledon cristata Haw. in Phil. Mag. 1827, 274 ; DC., Prod. Vol. 3, 399 (1828) ; Eckl. & Zeyh., Enum. 307 (1836) ; A.P. & A. DC. in Mem. Soc. Phys. Hist. Gen. Vol. 7 t. 7 (1836), *bona ;* Harv. l.c. 376 ; *partim, excl. syn. Haw. ;* Schonl. l.c. 155, *partim. et excl. syn. Haw. ;* Marl., Fl. S. Afr. Vol. 2, 1·20, t. 9·5 (1925) ; Phill. in Flow. Pl. S. Afr. Vol. 9, t. 325 (1929). *C. Zeyheri* Schonl. & Baker f. l.c. 91, *excl. spec. Zeyh. ;* non Harv. (1861–62).

SOUTH-EASTERN COASTAL REGION—Uitenhage distr.: (*sine loc. exact.*), *Bowie*! *s.n.* Type in Herb. Haw., Oxon.; dry hills on the Zwartkops Rivier, *E. & Z.* 1974, *partim* (Herb. Sond.); Port Elizabeth distr.: At Redhouse on dry hills, April 1915, *Mrs. Paterson* 442A! (Pa).

CENTRAL REGION—Albany distr.: In rocky places, near Grahamstown, *Schonland* 709! (Herb. Alb. Mus.). Graaff-Reinet distr.: At Graaff-Reinet, *cult. spec. plur. e Hort. Div. Pl. Ind. in Nat. Herb.* 7945! *et viv. spec.!* (Pa); dry hills near Graaff-Reinet, Nov. 1897, *Rattray*! *s.n.* (Herb. Alb. Mus.); occasional along basal slopes of mountain, near Graaff-Reinet, March 1930, *Galpin* 10275! (Pa).

Haworth's type specimen is preserved in his herbarium at Oxford, and is represented in the Kew collection of drawings by an exceedingly fine accurate coloured plate (No. 264) made from specimens sent by Bowie from the Cape (undoubtedly from the Uitenhage division) to Kew in 1823, the plate being prepared when the plants flowered in September 1826. That the original of the plate and Haworth's specimen both came from the type gathering is evident from the date of flowering cited and the fact that Haworth notes that his specimen flowered at Kew (Sept. 1826), N. E. Brown noting that he compared the plate with Haworth's type and found them to agree perfectly (Oct. 1901). Moreover, there is ample reason to believe that, in view of the rarity of the material sent by Bowie, a single specimen was figured and this same specimen passed on to Haworth.

This plate has also been very carefully compared with the original of the "Flowering Plants" coloured figure and found to match exactly, both also agreeing in every respect with A. P. & A. De Candolle's fine plate cited above.

18. A. clavifolius (*Haw.*) *Lem. ex Berger.*

This species was regarded by Harvey (2) as doubtfully conspecific with the previous species, but, though regarded as distinct, from *C. cristata* Haw., with which Schonland and Baker f. (4) had united *C. Zeyheri* Harv., Schonland (3) reversed this by excluding the last species, but united *C. clavifolia* Haw. with the former under that name. This latter step is by no means justified by reference to the type material and excellent figures, for they show most marked foliage and even floral differences. This was already noted by Haworth (Phil. Mag, 1827, 274) where he states "Priori (i.e. *C. cristata* Haw.) valde affinis at abunde distincta videtur. Folia subtrientalia, plusquam duplo angustiora, petiolo [*sic!*] incurvo, vix puberulo, ramentis caulinis forte paucioribus; cum eodem modo florendi; tubo subincurvo robustiore, viridi; laciniis intus albis, extus (uno latere) purpureis, et basi undulato-sublobulatis ut in priori". There is no specimen of *C. clavifolia* Haw. in Haworth's herbarium at Oxford, but there is a very fine coloured plate of a plant so-named in the collection of drawings at Kew, and, as explained under the previous species, there is every reason to believe that the plate represents Haworth's type, or at least an identical specimen, the material coming from the same source as the former species and flowering at Kew at the same time, Sept. 1826. This coloured plate must therefore, in the absence of a type specimen be chosen as the type.

The original specimen of the plate given in "Flowering Plants" (cited below) agrees perfectly with this plate, having been compared with it at Kew by the writer, and, as the original collections from which tt. 325, 328 of this publication were made, are still (1932) in cultivation at the Division of Plant Industry, Pretoria, where they had then been growing in the same greenhouse under similar conditions for nearly 6 years, typical specimens of the two Haworthian species were available for comparison. Thus the longer ovoid-elliptic to subcylindric terete dark green "body" of the leaves of *C. clavifolia* Haw., with their flattened but scarcely or not crisped and more or less abruptly constricted apices, contrast markedly with the much shorter dorso-ventrally somewhat compressed obovoid-cuneiform

to flabelliform paler green " body " of the leaves of *C. cristata* Haw. with their flattened and conspicuously crisped or undulate scarcely or not at all constricted apices. Their floral differences can best be seen by comparison of the two plates already cited.

Schonland and Baker f. ([4]) have suggested that in leafshape " it is more nearly allied to *C. Cooperi* ", but in this character it is far more nearly allied to *A. festivus* C. A. Sm., which has the same type of leaf apex. In the possession of the peculiar " petiolar " leaf base, however, *A. clavifolius* (Haw.) is far more nearly related to *A. cristatus* (Haw.) and *A. Zeyheri* (Haw.), with which it also agrees in indumentum and inflorescence characters, so that these two species would seem to be its closest affinities. The following would be the synonymy and citations under *Adromischus* Lem. :

A. clavifolius (*Haw.*). *Lem.* in Jard. Fleur. II, Misc. 60 (1852), *ex* Berger, l.c. 416, f. 199, B—E (1930) ; Jacobsen, Succ. Pl. (Eng. trans.), 16. excl. ref. fig. 6, 1, quae est spec. distincta.

Cotyledon clavifolius Haw. in Phil. Mag. 1827, 274 ; DC., Prod. Vol. 3, 399 (1828) ; Schonl. & Bak. f. l.c. 92 ; Schonl. l.c. 155.

C. cristata Harv. l.c. 376, *pro parte ; non Haw.* (1827).

C. Schonlandii Phill. in Flow. Pl. S. Afr. Vol. 9, t. 328 (1929).

" *A. van der Heydeni* Hort." ex Berger (*loc. sypra cit.*).

A. Schonlandii (Phill.) von Poellnitz in Cactus Journ. 1938, 68.

SOUTH EASTERN COASTAL REGION—Uitenhage distr. : (*sine loc. exact.*), *Bowie* ! Type (*ic. col. ined. tant. Herb. Bot. Reg. Kew. vidi*) ; on dry hills on the Zwartkopsrivier, Dec., *Eckl. & Zeyh.* 1974, *partim* (Herb. Sond.).

CENTRAL REGION—Graaff Reinet distr. : Near Graaff Reinet, *cult. spec. plur. e Hort. Div. Pl. Ind. in Nat. Herb.* 7944 ! (Pa, K).

In Harvey's description of *C. cristata* Haw., principally drawn from *E. & Z.* 1974 (Herb. Sond.), he states " leaves 1-1½ inches long . . . varying in breadth from 2 to 6–8 lines ; the narrower forms answer to the description of Haworth's *C. clavifolia* ". Both these two species grow in the same locality, and, though the writer has not seen the Herb. Sond. specimens of E. & Z.'s gathering, there can be no doubt that this number is composed of a mixture of the two plants, a point sufficiently evident from Harvey's observations. E. & Z. (Enum. 307 : 1836) only list " C. cristata Haw." under their number 1974, but without descriptive detail.

19. A. leucothrix *C. A. Sm.*, sp. nov. (Plate I.)

Planta nana, succulenta, perennis. *Caules* crassi, ad 4 cm. alti et 3 cm. diam. eis basibus tuberosis sed gradatim ad apicem foliosum angustati e parte supra basin nudo ad 6 mm. diam. subcylindrico, simplices vel ramis e basi brevibus paucis, laeves, glabri. ***Folia*** alternata et circum apices caulium vel ramorum dense aggregata, lineari-oblonga ad oblanceolata vel elliptico-oblonga, vix basin angustata, sed gradatim ad apicem obtusum angustata, ad 3·5 cm. longa et 5 mm. lata, ascendenti-erecta vel inferiores patentia, carnosissima, saturato-viridia et immaculata, prope basin subteretia, profunde in facie superiore sulcata sed inferire convexa, omnini crinibus hispidis albidis dense obtecta ut in foliis *Crassulae mesembrianthemoidis* (Haw.) D. Dietr. *Inflorescentia* simplex, pauciflora, racemoso-apicata ; rhachis erectus vel ascendenti-erectus, debilis, in inferiore parte dense sed breviter crinibus hispidis albidis obtectus. *Flores* non visi. *Carpellae* modo generis.

CENTRAL REGION—Ladismith distr.: On the eastern slope of a hill along the Ladismith-Calitzdorp road, Dec. 1926, *Liebenberg* ! *s.n.* Type (Pa).

The above species differs from all the other known species of the genus in the conspicuous white bristly unicellular hairs on the deeply sulcate leaves and lower part of the peduncles, thus giving these organs a distinct hoary appearance.

Described in greater part from notes made on the fresh type plant shortly after planting at Pretoria (Dec. 1926), and from the original photograph taken by the writer at that time and reproduced as Plate 1.

A later examination (April 1931) of the same plants (i.e. after they had been in cultivation in a warm green house for nearly five years) showed no variation in the density and character of the hairs on the leaves and peduncles, but the following dimensions will indicate the influence of green house conditions on a plant coming from an area with a mean annual rainfall of 15 inches.: *Stems* up to 15 cm. high and 1·5 cm. thick, with the bulbous swollen base 6 cm. in diam. *Leaves* up to 11 cm. long, 1 cm. wide and 8 mm. thick, and still with the deep sulcus on the upper face.

Apart from the character of the leaf indumentum, the species also exhibits other leaf characters (shape, cross-section, the deep groove) which make it unique in the genus, since none of the other species shows any character like it, but the nearest approach to the type of leaf in the above species is met with in *Cotyledon Wallichii* Harv., some narrow leaved forms of *C. ventricosa* Burm. f., *C. Dinteri* Bak. f., and *C. cacalioides* Linn. f., though, of course, the leaves of none of these in the fresh state show the grooving or indumentum which characterises the *Adromischus*. The non-flowering plant also bears a strong superficial resemblance to *Crassula mesembrianthemoides* (Haw.) D. Dietr. =(*Cr. trachysantha* E. & Z.), but from this it is readily known by its succulent (not shrubby) stems, alternate (not opposite) leaves and their shape (not triangular in cross-section).

20. A. Alstoni (*Schonl. & Bak. f.*) *C. A. Sm.*, comb. nov.

Described from a specimen collected by G. Alston in Namaqualand and cultivated by Dr. Schonland in the Albany Museum Herbarium garden, where it flowered in Jan. 1901. It is very closely related to *A. triflorus* (Linn. f.), from which it appears to differ in its longer but narrower leaves, in the colouration of the flowers, and in the shape of the corolla-lobes. Unfortunately, the type of *A. triflorus* (Linn. f.), Thunberg's Zeekoerivier specimen, was not available for examination, so the characters in the following table under this name were taken from Thunberg's excellent description made obviously (in greater part at least) from notes on the fresh plant at the time of collection:

A. Alstoni.	*A. triflorus.*
Folia ad 7 cm. longa et 2·5 cm. lata.	*Folia* ad 5·5 cm. longa et 2·5 cm. lata.
Corollae tubus viridis, ad 1·5 cm. longus.	*Corollae tubus* " viridi-rufescens, subunguicularis."
Corollae lobi deltoideo-acuminati, pallide rosei vix 2 mm. longi.	*Corollae lobi* " ovatae, obtusae, intus albae, extus rufescentes, lineam longi."

Thunberg's description does not include the leaf shape of his plant, though he says: " folia. . . . obtusissima, subtruncata, inferne attenuata, basi teretiuscula ", and from the dimensions above given, this would indicate an obovate leaf long-cuneate to the base, Alston's specimens also having the leaves obovate and long cuneate to the base and rounded at or only very slightly tapering to an obtuse apex. In the latter, too, the flowers are sometimes singly disposed along the rhachis, or in 3-flowered cymules, whereas in the Thunberg specimens, the 3-florous condition seems consistently to obtain, at least in the maturer basal half of the inflorescence.

The species appears to have been omitted by Berger (1), hence the following new combination is proposed for it under *Adromischus* Lem. :

A. Alstoni (*Schonl. & Bak. f.*) *C. A. Sm.*, comb. nov.

Cotyledon Alstoni Schonl. & Bak. f. l.c. 93 ; Schonl l.c. (154).

A. Cooperi Jacobsen, succ. Pl. (Engl. trans.) 16 (1935) excl. syn. ; non Berger.

Western Region--Namaqualand Minor (*sine loc. exact.*), anno 1900, *G. Alston* ! *s.n.* Type (Herb. alb. Mus., K).

Of this plant the writer has only seen the dried specimens taken from the type collection at the time of flowering. Jacobsen (loc. supra cit.) described a plant which appears beyond doubt to be *A. Alstoni*.

21. A. Marianae (*Marl.*) *Berger*.

This is another of the species confined to the western area (Clanwilliam distr.) of the Cape Province, and is well characterised by its oblong greyish-green fleshy leaves which show a more or less semicircular cross-section and are conspicuously marked with purple-brown flecks and blotches over their whole surface. The fine coloured plate of the plant cited below also shows a rooting leaf, which had originally broken off from a fresh specimen and left lying on a shelf in the late Dr. R. Marloth's laboratory. Here, after a period of several months, the leaf developed adventitious roots and new leaves at its base.

A. Marianae (*Marl.*) *Berger*, l.c. 416.

Cotyledon Marianae Marloth in Trans. S. Afr. Phil. Soc. Vol. 18, 47 (1907) : Schonl. l.c. 153 ; Marl., Fl. S. Afr. Vol 2, 1. 14. t. 3, f. A (1925), *bona*.

Western Region—Clanwilliam distr. : Stony slopes of a mountain near Clanwilliam, 1,000 ft., March 1898, *Leipoldt in Herb. Norm. Austro-Afr. Cent. XIX*, 1860 ! (K, Pa).

Leipoldt's specimen was erroneously distributed by MacOwan in 1899 as "Cotyledon mammillaris Linn. f.", but agrees with every detail of the fine plate of the type plant, of which, however, the writer has not seen the dried material.

22. A. humilis (*Marl.*) *Berger*.

One of the most distinct species in the genus, with the following most outstanding characters : A dwarf succulent perennial without any sign of a stem. *Root* tuberous below the crown. *Leaves* flat, rosulate, alternate. *Peduncle* very short, laxly 2-5-flowered, the 7-flowered condition only found in cultivated specimens. *Corolla-tube* yellowy-green and slightly tapering to the base ; limb stellately spreading or at length reflexed, deep purple to maroon.

A. humilis (*Marl.*) *Berger*, l.c. 417.

Cotyledon nana Marl. in Trans. Roy. Soc. S. Afr. Vol. 2, 33 (1910) : non N. E. Br. (1902).

C. humilis Marl. apud. Schonl. l.c. 151 and Fl. S. Afr. Vol. 2, 1. 16, 17. t. 3, f. D (1925), *bona*.

Central Region—Beaufort West distr. : On the Nieuweveld Mtns., Dec. 1909, *Marloth* 4689 ! Type (Pa).

So far only recorded from this locality, which in the early half of last century was one of the fruitful collecting grounds of Marloth's countryman, the equally energetic J. F. Drége, but he appears to have missed the plant altogether.

23. A. nanus (*N. E. Br.*) von Poellnitz (Pls. II., III.)

This species was first described (as *C. nana* N. E. Br.) in 1902 from a plant sent " in 1899 by Prof. MacOwan from South Africa to Kew " where it is still alive and flourishing (1930), being for some time cultivated in the late Dr. Brown's conservatory at Kew, and there photographed in Sept., 1920. An authenticated photo of the plant (Plate II) was shortly afterwards sent to the Division of Plant Industry, Pretoria, but the original description appears to lack some of the details which are evident even in the photo, such as the subdistichous arrangement of the leaves which are among the smallest in the genus.

The locality from which MacOwan originally obtained his plant (the type) is not known, but almost certainly it came from Middelburg (Cape), whence he had plants sent him in 1898–99. That this part of the central region may be involved is further indicated by the fact that a plant collected by Dr. T. R. Sim in January, 1902 at Hanover, in the district adjoining Middelburg, agrees in every essential detail as far as vegetative parts are concerned with N. E. Brown's type. The latter, however, at the time it was described, bore only a very short (" ½ inch long ") peduncle, with a single, apparently terminal, flower, whereas Sim's specimen shows the typical raceme found in the species belonging to the northern group (cf. p. 615). That the inflorescence of the type plant is not a normal one is amply borne out by the fact that even in the wild state, this group is frequently seen to produce abnormal floral features, a condition even more frequently met with in cultivation, where soil, water, or biotic factors may even retard flowering for several years ! Some, or all of these factors seem to have operated in the type plant, since it has not flowered once again so far as observation at Kew has shown during the last 30 years, and even its leaves remain far smaller than those of wild specimens which are beyond doubt conspecific. As Brown also cautiously observes (*loc. infra cit.*), " the one-flowered peduncle may not be a constant character, as other species of the group have a spicate [or racemose] inflorescence ". The following description, which will serve to amplify the original in further leaf and inflorescence detail, was drawn largely from flowering specimens (seen in Plate III) collected by the writer, and from Sim's excellently dried material, parts of the original incorporated being indicated in inverted commas :

Plant a dwarf succulent perennial, glabrous in all parts, but the leaves and inflorescence covered with a thin waxy bloom. *Stem* at most 2 cm. high, stout and fleshy, very slightly and inconspicuously 2- (or not at all) branched at the apex. *Leaves* closely crowded at the apical part of the stem (or crown of the rootstock in the subacaulescent forms), alternate (frequently apparently opposite), distichous, or subdistichous owing to overcrowding at the apices, broadly oblong-elliptic to orbicular or reniform, broadly rounded at, and never tapering to the base and apex (the latter very rarely, and then only casually, subacute), up to 1·5 cm. wide and about as much long, erect or ascending-erect, very thickly fleshy, with the thickest part (up to 3·5 mm.) in the middle, convex on either side, whence narrowly elliptic or oblong-elliptic in cross-section, thinnest towards the apical margin, the margin itself white and cartilagineous, greyish-green in colour, invariably spotted with numerous purple-red to purply-brown flecks (especially in the upper half), the blotches flowing into a continuous irregular blotch under the apex. *Inflorescence* single and simple, terminal and up to 25 cm. long (or more ?), including the nude lower peduncular part, laxly racemose in the upper half or third. *Flowers* generally spreading on their short pedicels and subsecundly arranged when opening, erect or ascending-erect after fertilisation and in the bud stage. *Pedicels* up to 5 m.m. long in the fruiting stages, arising in the axils of much reduced ovate acute membranous spreading bracts, terete, more or less insensibly widening into the calyx. *Calyx* fleshy, with narrowly ovate-deltoid, very acute up to 2 mm. long teeth. *Corolla tube* cylindric, " slightly clavate ", straight, obtusely 5-angled, up to 1·2 cm. long, " reddish-brown with . . . greenish-angles ", or purplish-brown, and purplish in the throat ; lobes reflexed, ovate-acute, up to 2 mm. long, " rosy-purple with whitish margins

and with the mouth of the tube at the sinuses somewhat membranous and whitish ". "*Stamens* included; anthers ochreous-yellow ". Ovaries 5, oblong-ovoid, up to 8 mm. long, and tapering insensibly into their subulate styles. *Nectarial scales* obovate to oblong-obovate, deeply notched at the apex.

The following are the details of synonymy and citations for the species which appears to have been missed by Berger (Engl. & Prantl., Nat. Pflanzenfam. XVIII, a. 416 : 1930):

A. nanus (*N. E. Br.*) von Poellnitz comb. nov. in Desert Plant Life 227 (1938).

Cotyledon nana N. E. Br. in Gard. Chron. Ser. 3, vol. 30, 280 (1901); *non* Marl. (1910).

"C. B. S."—(*sine loc. exact.*, sed forsan in ditione Middelburg dicta), anno 1899, *Spec. cult. leg. MacOwan*! Type (Hort. Reg. Bot. Kew.).

Central Div.: Hanover distr.: Hillside at Hanover, Jan., 1902, *Sim in Herb. Galpin* 5975! Lecto-type (Pa).

Orange Free State— Fauresmith distr.: Upper half of western slope of hill on the Fauresmith Botanical Reserve, east of the town, April, 1927, *Spec. cult. leg. Smith*! (Pa).

In view of the uncertainty attendant upon cultivation and the fact that no dried specimen of the original type is preserved in Herb. Kew., the writer would suggest that Sim's specimen above cited be chosen as the type of the specific name, the specimen being perfectly complete in all details.

The following are the associated plants shown in the photograph reproduced as Plate III, reading from left to right: *Crassula obvallata* L., *Adromischus nanus* (N. E. Br.) von Poelln., * *Kleinia radicans* (Thunb.) Haw., lying prostrate in the foreground, *Crassula obvallata* Linn., with the dried remains of the previous season's inflorescence, *Euphorbia aggregata* Berg. (spiny), *Haworthia tessellata* Haw., with its fruiting inflorescence lying over the *Crassula* just obliquely above it, † *Cotyledon toxicaria* C. A. Sm., with a dried inflorescence on it, and ‡ *Eustachys paspaloides* (Vahl) Lanza & Matti in the right background. The dried objects in the foreground are leaves of the *Haworthia* and the *Cotyledon*, together with 3 old capsules of the latter.

24. A. procurvus (*N. E. Br.*) *C. A. Sm.*

Known so far only from a single cultivated specimen, the type being preserved in Herb. Kew., being chiefly characterised by its curved corolla-tube. In a genus of some 30 species, all with straight corolla-tubes, an unusual character such as a curved corolla-tube is of special interest, but, in as much as many of the species are subjected to teratalogical modifications resulting from mechanical or biotic (e.g. aphid) injury, the curvature of the corolla tube in this particular case may have been due to such injury. In the meantime, until experimental evidence has been obtained in this direction, and for the purpose of calling attention to the plant, its specific rank is here maintained under *Adromischus* Lem., from which it was omitted by Berger (Engl. & Prantl, Nat. Pflanzenfam, Vol. 18, a. 416 : 1930).

A. procurvus (*N. E. Br.*) *C. A. Sm.*, comb. nov.

Cotyledon procurva N. E. Br. in Kew Bull. 1912, 276; Schonl. l.c. 154.

"C. B. S."—(*sine loc. exact.*), *Spec. cult. Hort. Bot. Reg. Kew*! (K). Type.

It is most closely allied to the next two species, from which, however, it must, at least for the present, be excluded by its curved corolla tube, if not on foliage characters also.

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* Erroneously cited as of "DC." by Harv. l.c. (317).

† *C. decussata* Phill. & C. A. Sm. in Flow. Pl. S. Afr. Vol. 8, t. 289 (1928); non Sims (1824).

‡ *Eustachys* (Chloris) *petraea* Auct.; non *Chloris petraea* Swartz.

25. A. trigynus (*Burch.*) von Poellnitz.

Known only from a few specimens collected in Griqualand West by Burchell in Dec. 1811, but they are incomplete as to leaves, these having apparently been lost, so that the species requires to be recollected in the type locality (*v. infra*), when a fuller description of the vegetative as well as floral parts may be drawn up, and its specific identity determined in terms of the preceding and the next species. The specific epithet " trigyna " is inappropriate and misleading, since in the type specimens the number of carpels vary from 3–4–5, with the last number probably the more usual as in the other species of the genus. Thus Baker fil. & Schonland (5) also observe that in the flower dissected by them from the type, the normal number of carpels was found. In the matter of descriptive detail, the following, a copy of Burchell's original field label, represents all that is known as to leaf characters :

" 1898—

Cotyledon trigyna B. folia cuneato-ovata (vel suborbiculata), glabra complanata carnosa. Acaulis. Flores scapo elongato simplici (rarissimo bifido), basi nudo alterni erecti. Corolla cylindrica purparascens limbo albo brevi reflexo. Faux purpurea. Capsula tres.
Dec. 14, 1811.

At Klaarwater, in the kloof near the Burying Ground."

Burchell's final published description was no more than a re-arrangement of the characters already noted on his field label, with the addition " flores erecti alterni ", and to these the above two authors added " Calyx lobes lanceolate subacuminate, ± 2 mm. long. Corolla tubular, much longer ; the tube (sphalm. " calyx ") ± 1·3 cm. long ; lobes reflexed or subreflexed, about 2 mm. long, acute."

A. trigynus (*Burch.*) von Poellnitz in Fedde Rep. 44, 60 (1938).

Cotyledon trigyña Burch., Trav. Vol. 2, 226 (1824) ; DC., Prod. Vol. 3, 398 (1828) ; Harv. l.c. 378 ; Schonl. & Bak. f. l.c. 91 ; Schonl. l.c. 153.

Griqualand West—Hay distr. : At Klaarwater (=Griquatown) " in the Kloof near the Burying Ground ", Dec. 1814, *Burchell* 1898 ! Type (K & Herb. DC.).

Those plants, chiefly from the Transvaal Highveld, which have been identified as this species, belong to the next but one.

26. A. rupicolus *C. A. Sm.*, sp. nov. (Fig 4.)

Cotyledon trigyna Marl., Fl. S. Afr. Vol. 2, 1. t. 2, f. D (1925) ; *non Burch.* (1824).

C. rhombifolia var. *spathulata* N. E. Br. ex Marl. (*loc. cit. in icon.*).

Planta humilis, succulenta, perennis, in partibus omnibus glabra. *Caules* ad 4·5 cm. alto, crassi, simplices vel ramis brevissimis crasissimis, circum apices dense foliosi, et parte inferiore frequenter prostrati, tum ad 2·5 cm. crassi et terra semi-obtecti. *Folia* opposita decussata, late oblongo-elliptica ad suborbicularia, vix ad basin late amplectentem angustata, apice rotundata, rarissime emarginata vel mucromata, ad 5 cm. longa et 2 cm. lata, carnosissima, superne inferneque convexa, ad 4 mm. in medio crassa, sed ad apicem et margines cartilagineas angustiora, viridia, semper irregulariter maculis saturartoris viridibus maculata, sed maculis purpurascentibus vel purpureo-brunneis sub marginibus apicis dense collectis. *Inflorescentia* ex planta singula 1–2, simplex, racemosa, ad 50 cm. longa (pedunculo nudo incluso) ; rhachis subflexuosus vel rectus, plus minusve rigidus sed prope apicem

subcernuus, brunneus vel purpureus, teres. *Flores* longe pedicellati, postanthesin subsecundi, sed post florentem ascendentes. *Pedicelli* ad 1 cm. longi, post florentem ad 4 cm. elongati, debiles, teretes, pedunculo concolorosi, bracteis ad 1 mm. longis ovatis carnosis. *Calyx* viridis, carnosus; dentes ovato-lanceolati, acutissimi, ad 2 mm. longi, carnosi. *Tubus corollae* cylindricus, rectus, ad 1·5 cm. longus, obtuse 5-angulatus, rubro-purpureus, fauce purpureus vel saturate ruber; lobi ovati, acuti, ad 2 mm. longi, reflexi, pallidissimi purpurei vel in senioribus albescentes, inferne saturate purpurei, marginibus undulatis vel crispulatis. *Stamina* 2-seriata, plerumque 4 exserta, alia inclusa; filamenta saturate purpurea, plerumque 4 paululum altiora in tubus corollae quam aliis inserta; antherae ovoideae, albescentes. *Ovaria* 4–5, oblongo-ovoidea, ad 1 cm. longa, ad basin paululum cuneata, in stylo subulato ad apicem angustata · styli sub antheras staminum exsertorum breviter excurvati. *Squamae nectarii* obovatae, manifester emarginatae.

Central Region—De Aar distr.: On the slope of a hill to N.W. by W. of De Aar, in rocky crevices almost right under stones, Nov. 1926, *Liebenberg* 263! (Pa).

Orange Free State—Fauresmith distr.: On the Fauresmith Veld Reserve, near the crest of the hill among rocks and in crevices of rocks, 4,650 feet, Dec. 1937, *Smith* 5203! Syn-type (Pa), *& in eod. loc.*, Jan., 1928, *Smith* 5603! Type (Pa).

Western Transvaal—Marico distr.: Among rocks at Zeerust, 4,000 feet, Dec. 1926 *van der Merwe* 37! (Pa).

This species, figured in the accompanying illustration (Fig. 4), is locally known as "plakkie" or "bontplakkie", and invariably, unlike *A. nanus* (N. E. Br.) von Poellnitz grows socially in crevices and in the shade of rocks, with the long graceful inflorescences projecting well above their immediate rocky environment and so readily accessible to insect visitors. The plant is common on the hillsides, usually in the upper half of the western slopes near the crest, round the Fauresmith in the district, and, judging from the above, appears to be one of the few with a relatively wide distribution.

On the Fauresmith Reserve, the plant is very generally found among rocks under taller shrubs and bushes such as *Rhus Burchellii* Sond., * *Ehretia rigida* (Linn. f.) Druce, *Rhigozum obovatum* Burch., along with other such dwarf social succulents as *Kleinia radicans* (Thunb.) Haw. and *Haworthia tessellata* Haw. mixed with it, or in shady places not under other plants and associated with other succulents such as *Euphorbia aggregata* Berger, *Cotyledon toxicaria* C. A. Sm. (see p. 641), *Crassula obvallata* Linn. and *Mesembryanthemum saxicolum* † (L. Bolus) N. E. Br., *Stapelia flavirostris* N. E. Br. Marloth's fine coloured plate cited above agrees in all essential detail with a partly coloured plate made from the type specimen of which Fig. 4 is the rendering in monochrome.

27. A. umbraticolus, *C. A. Sm.* (Pls. IV, V.)

This species was first described in connection with toxicological experiments carried out at Onderstepoort (near Pretoria) by Dr. D. G. Steyn (see p. 615), and as the Journal containing the publication may not be readily accessible to other workers in the field of systematic botany, the description is given here in full:

Plant a succulent sometimes acaulescent perennial, glabrous in all parts, but covered on the leaves and inflorescence parts with a thin white waxy bloom. *Stem* (where present) stout and well-developed, up to 12 cm. high and 2 cm. thick, erect, simple or usually dichotomously branched in the upper half, terete, closely leafy toward and round the apices, with knobby excrescences marking the old leaf scars on the lower nude part, and covered

* *E. hottentotta*, Burch. of Thiselt.-Dyer, Fl. Cap. IV, 2·5 (1904).

† *Ruschia saxicola*, L. Bolus. The above determination was made for the writer by the late Dr. N. E. Brown at Kew from Dr. L. Bolus' type number, also collected by the writer on the Fauresmith Reserve.

with a thin greyish- or ashy- to yellowish-green skin. *Branches* resembling the stems, but thinner, up to 3 cm. long, simple or again shortly branched. *Leaves* alternate, occasionally pseudopposite at the apices of the branches, decussately arranged or somewhat scattered, oblong to obovate-cuneate, gradually narrowed from near, and toward, the base, usually rounded at the apex (or casually abruptly narrowed to a subacute, often in the younger stages, slightly crisped apex), up to 5 cm. long and 2 cm. wide, erect or ascending-erect, frequently (the lower) incurving-erect, very fleshy and up to 4 mm. thick in the middle near the base, gradually thinner towards the apical margin, green, often purple-red flushed at the apex, but never spotted, convex on the outer, and convex or flattened on the inner face in the upper half, convex on both surfaces in the lower half, and hence elliptic to oblong-elliptic in cross-section. *Inflorescence* apparently terminal or axillary, simple or with 2–3 branches, laxly racemosely-flowered in the upper half, nude, or with a few scattered and much reduced sterile scale-like bracts in the lower half; rhachis rigidly erect or subcernuous near the apex, up to 35 cm. long, terete, brownish-purple. *Flowers* subsecund when open, and spreading, erect after fertilisation and in the bud stage. *Pedicels* up to 6 mm. long prior to, and 1 cm. long during the fruiting stage, most usually with 1–3 much-reduced lanceolate-ovate bracteoles, the lower occasionally with a sessile non-maturing flower from the upper bracteole, terete, and insensibly widening into the calyx, arising from the axils of much reduced ovate to ovate-lanceolate acute up to 1·5 mm. long bracts. *Calyx* purply-brown, fleshy; teeth ovate-deltoid, acuminate, up to 2·5 mm. long, fleshy and convex on the outer face and adpressed to the corolla. *Corolla-tube* cylindric, straight, obtusely 5-angled and marked with 5 evident sulci between the angles, up to 1 cm. long, purple to mauve-purple on the outer face deep mauve to maroon-coloured in the throat, scarlet to deep coral-red in the bud; lobes ovate-deltoid, acuminate, up to 2 mm. long, purple to mauve, thin and delicate; the limb at first spreading but at length reflexed. *Filaments* filiform, inserted as in the former species, purplish-mauve at the apex. *Anthers* ovoid, creamy-white or purple-flushed before dehiscence. *Ovaries* 4–5, oblong-ovoid, up to 5 mm. long, tapering into the subulate green styles. *Nectarial scales* oblong, up to 1·5 mm. long, very slightly notched at the apex, pale green.

A. umbraticolus, *C. A. Sm.*, in Onderstepoort Journ. Vet. Sc. & An. Ind. Vol. I, 174 (1933).

Cotyledon trigyna Burtt Davy, Fl. Transv. & Swaz. Vol. I, 142, 143 (1925), *pro majore parte, sed. excl. syn. et non-Tvl. exsicc.; non Burch.* (1824).

TRANSVAAL HIGHVELD.—Pretoria distr.: On the Magaliesberg at Silikaatsnek, in rocky crevices in shady places along the northern slopes, 5,000 ft., Nov. 1926, *Smith* 3432! Type (Pa); at Wonderboom, along rocky ledges and in crevices of precipitous sides of cliffs in the northern entrance to the Poort, 4,650 ft., Dec. 1925, *Smith* 1766! (Pa); On the farm "Witfontein", along upper half of northern slopes of the Magaliesberg, about 2 miles west of Wonderboom Poort, 4,600 ft., July 1933, *Smith* 6272! (Pa); at Pretoria, along northern slopes (upper half) of Meintjeskop range, below the crest near the old Fort in rocky crevices, 4,800 feet, Sept. 1925, *Smith* 693A! (Pa), and in rocky fissures and crevices in rich humus on the same range below the Reservoir, 4,800 ft., Nov. 1926, *Smith* 3456! (Pa), & *eod. loc.*, June 1931, *Smith & Ward* 3! (Pa). Witwatersrand distr.: Rocky crevices on a koppie at Braamfontein, near Johannesburg, 6,000 ft., Nov.-Dec. 1898, *Gilfillan* 60! (Pa).

A very common plant on the ranges round Pretoria and along the northern slopes of the Magaliesberg, invariably found growing socially (like the last species) in rocky crevices and fissures, with the vegetative parts in shade of other plants (Plate IV) and the rootsystem under rocks or often firmly wedged into the crevices, the inflorescence being exposed to the open where the flowers are more readily accessible to insect visitors. Fig. 5 shows a typical specimen:

with a thin greyish- or ashy- to yellowish-green skin. *Branches* resembling the stems, but thinner, up to 3 cm. long, simple or again shortly branched. *Leaves* alternate, occasionally pseudopposite at the apices of the branches, decussately arranged or somewhat scattered, oblong to obovate-cuneate, gradually narrowed from near, and toward, the base, usually rounded at the apex (or casually abruptly narrowed to a subacute, often in the younger stages, slightly crisped apex), up to 5 cm. long and 2 cm. wide, erect or ascending-erect, frequently (the lower) incurving-erect, very fleshy and up to 4 mm. thick in the middle near the base, gradually thinner towards the apical margin, green, often purple-red flushed at the apex, but never spotted, convex on the outer, and convex or flattened on the inner face in the upper half, convex on both surfaces in the lower half, and hence elliptic to oblong-elliptic in cross-section. *Inflorescence* apparently terminal or axillary, simple or with 2–3 branches, laxly racemosely-flowered in the upper half, nude, or with a few scattered and much reduced sterile scale-like bracts in the lower half; rhachis rigidly erect or subcernuous near the apex, up to 35 cm. long, terete, brownish-purple. *Flowers* subsecund when open, and spreading, erect after fertilisation and in the bud stage. *Pedicels* up to 6 mm. long prior to, and 1 cm. long during the fruiting stage, most usually with 1–3 much-reduced lanceolate-ovate bracteoles, the lower occasionally with a sessile non-maturing flower from the upper bracteole, terete, and insensibly widening into the calyx, arising from the axils of much reduced ovate to ovate-lanceolate acute up to 1·5 mm. long bracts. *Calyx* purply-brown, fleshy; teeth ovate-deltoid, acuminate, up to 2·5 mm. long, fleshy and convex on the outer face and adpressed to the corolla. *Corolla-tube* cylindric, straight, obtusely 5-angled and marked with 5 evident sulci between the angles, up to 1 cm. long, purple to mauve-purple on the outer face deep mauve to maroon-coloured in the throat, scarlet to deep coral-red in the bud; lobes ovate-deltoid, acuminate, up to 2 mm. long, purple to mauve, thin and delicate; the limb at first spreading but at length reflexed. *Filaments* filiform, inserted as in the former species, purplish-mauve at the apex. *Anthers* ovoid, creamy-white or purple-flushed before dehiscence. *Ovaries* 4–5, oblong-ovoid, up to 5 mm. long, tapering into the subulate green styles. *Nectarial scales* oblong, up to 1·5 mm. long, very slightly notched at the apex, pale green.

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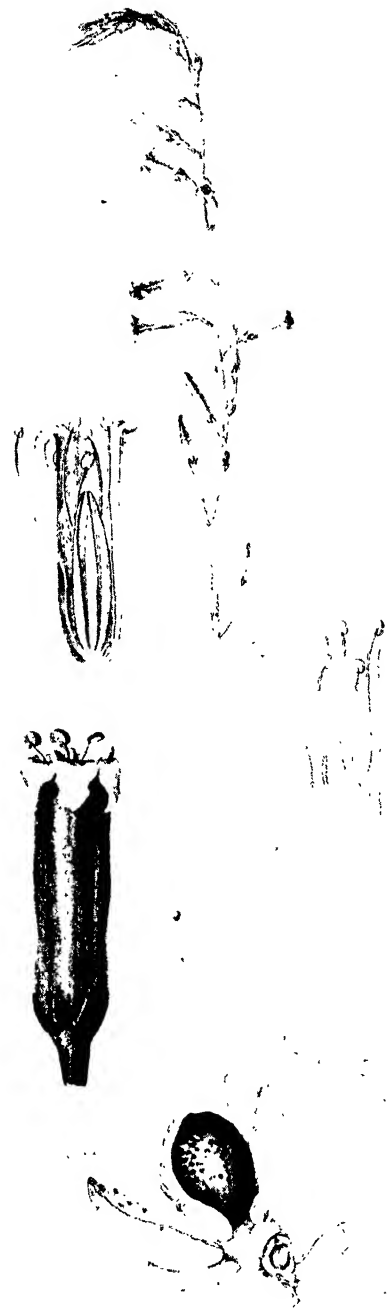

Fig. 4.—*A. rupicolus* C. A. Sm. Sketched from the living plant (the type) collected by the writer (Smith, 5603). See text.

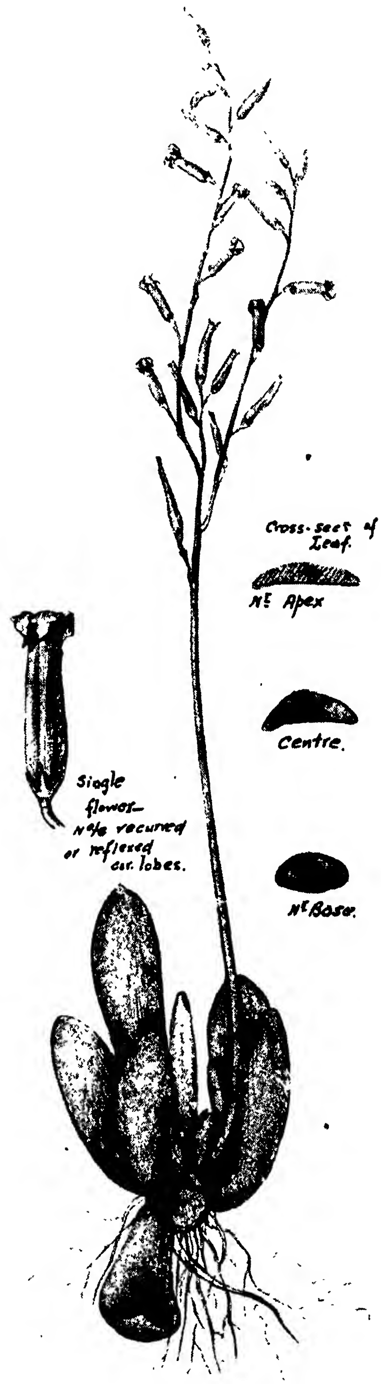

FIG. 5.—*A. umbraticolus*, C. A. Sm. Sketched from the living plant, the type. See text.

In the Meintjeskop localities the plants were found forming practically pure stands under dwarf arborescent specimens of *Strychnos pungens* Sol. (Plate IV), *Vangueria infausta* Burch., *Combretum Gueinzii* Sond., and very commonly also under tangled masses of *Landolphia capensis* Oliv., or in other cases associated with one or very generally more of the following: *Crassula argyrophylla* Diels (commonly so), *Euphorbia Schinzii* Pax, *Salacia Rehmannii* Schinz, *Kalanchoe paniculata* Harv., *Aloe Davyana* Schonl., *A. transvaalensis* O. Ktze., *Becium angustifolium* Benth., *Pachystigma Zeyheri* Sond., *Lannea edulis* (Sond.) Engl., *Leonotis microphylla* Skan and *Cotyledon leucophylla* C.A. Sm. *Huernia Loesneriana* Schltr.

The accompanying photo (Plate IV). taken by the writer in Nov. 1926, shows *Smith* 3456 growing under a specimen of *Strychnos pungens* Sol., with trailing branches of *Landolphia capensis* Oliv. (to the left and top right of the photo), the numerous erect peduncles with their long racemes forming an interlaced mass above the plants.

The next photo (Plate V) shows the plant in more open situations due to removal during the previous year or two of the sheltering *Landolphia capensis* Oliv. (seen to left and bottom right of photo) by nocturnal hunters for the notorious but legendary "Kruger millions" (note the hole in the centre).

This species is of interest in that the pedicels bear 1–3 bracteoles along the lower pedicels, from one of which (the upper) a sessile and generally abortive flower may arise, thus indicating an approach to the 3-florous condition seen in other species of the genus already noted (see p. 617), though in the former the pedicelled condition prevails, and it is a feature of further interest to note that the bracteoles with barren flowers were seen only in cultivated specimens thus far.

The leaves of this species also behave like those of *A. Marianae* (Marl.), i.e. when they drop or are broken off from the parent plant desiccation does not follow immediately, but adventitious roots are developed at the base, followed in time by tufts of leaves, the genesis of one or more new plants. Both the two leaves seen in the foreground in Plate V had started to root in this manner, the one on the right having also produced new leaves.

28. A. saxicolus, *C. A. Sm.*,

Planta nana, succulenta, perennis, in partibus omnibus glabra, locis apricosis crescens. *Radix* plerumque multus incrassatus et succulentus, ad 2 cm. diam., basi nodulis rotundatis. *Caules* e corona radicis 1–3 (vel plus), breves (ad 2·5 cm. alti), crassi (ad 1 cm. diam.), ad apices dense foliosi, vel caules 0, foliis tum circum coronam rotundatam aggregatis. *Folia* dispersa, vel summa pseudopposita, dense congesta et subrosulata, lineari-oblonga ad oblongo-elliptica, plus minusve ad basin et apicem auctum equaliter angustata, ad 3·5 cm. longa et 1 cm. lata, carnosissima et ad 5 mm. in medio crassa, superne inferneque convexa, viridia, immaculata, pallide rosea in superiore parte. *Inflorescentia* simplex; rhachis rigide erectus, ad 25 cm. longus, simplex. *Flores* pedicellati, in cymulis 1-floris dispositi, post anthesin patentes et subsecundi, postquam impregnationem ovariorum erecti. *Pedicelli* ad 5 mm. longi, vel 7 mm. in fructu, teretes, saepe bracteola membranacea subulata onusti. *Calyx* cinereo-viridis, carnosus; dentes lanceolato-deltoidei, acuminati, ad 1·5 mm. longi. *Tubus corollae* cylindricus, rectus, obtuse 5-angulatus, ad 8 mm. longus, purpurascens, in fauce purpureus vel saturate ruber: lobi ovato-deltoidei, acuminati, ad 1·5 mm. longi, purpurei, sed pallidioribus marginibus, deinde reflexi. *Filamenta* filiformia, ut more sectionis in tubo corollae inserta, ad apices purpurea, infra viridescenti-lutea. *Antherae* ovoideae, post anthesin lutescentes vel purpureae. *Ovaria* 5, oblongo-ovoidea, ad 5 mm. longa, in stylo viride subulato angustate. *Squamae nectarii* oblongo-cuneatae, ad 1 mm. longae, apice breviter emarginatae, pallido-virides.

TRANSVAAL HIGHVELD—Pretoria distr.: At the southern entrance to Baviaanspoort, on the Magaliesberg, growing socially on rocky ledges and in crevices filled with black humus, 4,500 ft., Nov. 1926, *Smith* 3424 ! Syntype (Pa) ; at Premier Mine, in open places on a koppie to east of the mine, growing in rocky depressions and crevices, June 1931, *Smith & Ward* 5 ! Type (Pa).

The plant is closely related to the previous species, but from this it is readily known by its rootstock, the acute leaves (only very casually obtuse), as well as by their shape, and its consistently dwarf habit. Found only in one locality at the Premier Mine associated with *Crassula argyrophylla* Diels, *Euphorbia truncata* N. E. Br., *E. Schinzii* Pax, *Lopholaena coriifolia* (Sond.) Phill. & C. A. Sm., *Selaginella rupestris* Spreng., *Parinarium capense* Harv., and the very dwarf forms of *Burkea africana* Hook.

SPECIES EXCLUSA.

The *Cotyledon* described by Haworth (Misc. Nat. 180: 1903) as *C. caespitosa* Haw. with " Habitat ad Cap. Bon. Sp." is not a Cape plant at all, but, as later corrected by Haworth himself (Syn. Suppl. Succ. Ed. Germ. 117: 1819), is a Californian plant, said to be conspecific with *C. linguaeformis* (Ait. Hort. Kew. Ed. 2. Vol. 3, 109: 1812), which was obtained from California (see Saund., Ref. Bot. I. t. 69 : 1869). It belongs to a genus now excluded from *Cotyledon* Linn. (emend.).

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(1) Englor and Prantl, Nat. Pflanzenfam, Vol. 18. (1930.)
(2) Harvey and Sonder, Flora Capensis, Vol. 2 (1861-62).
(3) Records of the Albany Museum, Vol. III (1915).
(4) Journal of Botany, Vol. 40 (1902).

Plate I.—*A leucothrix* C.A. Sm. Type plant.

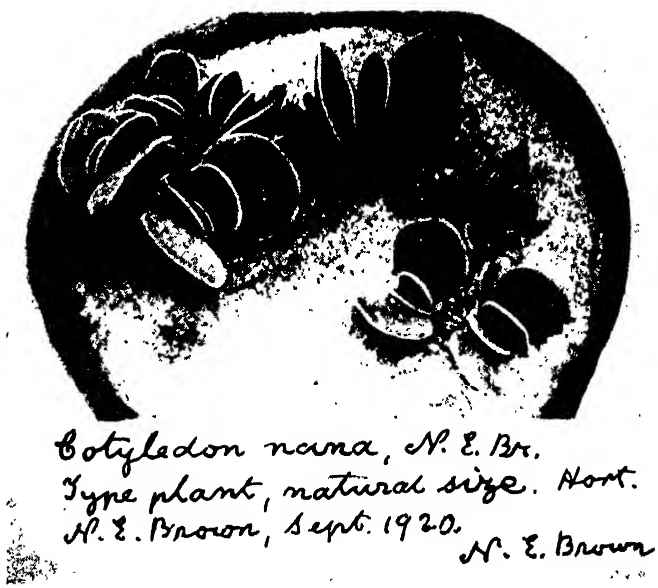

Plate II.—*A. nanus* (N. E. Br.) von Poellnitz Type plant photographed by Miss. Brown, Sept., 1920 (see text).

Plate III.—*A. nanus* (N.E. Br.) von Poell., photographed in its native habitat with a group of associated succulents by the writer in April, 1927. (See text.)

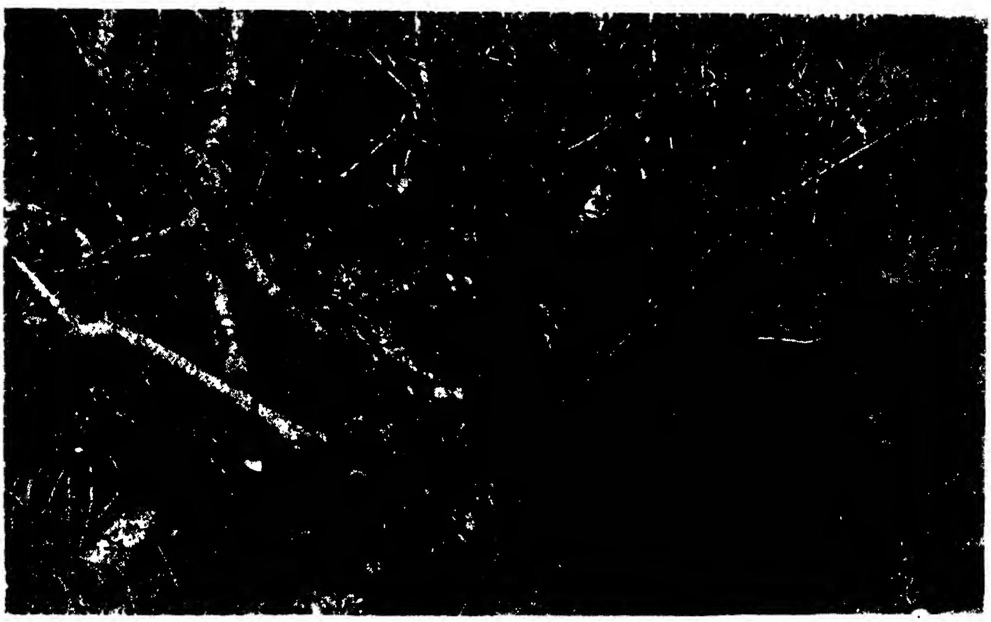

Plate IV.—*A. umbraticolus* C.A. Sm., in its natural habitat. (See text.)

Plate V.—*A. umbraticolus* C.A. Sm., with associated plants. Photo taken by the writer (Nov 1926), slightly to the right of the one shown in plate IV. (See text.)

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OTHER SPECIES CITED IN THE TEXT.

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